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WITH WHICH ARE INCORPORATED
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Institute of Metals Division Meeting

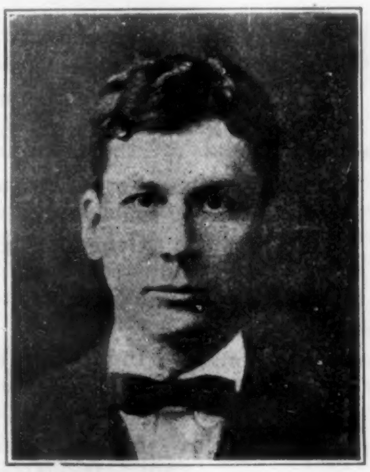
Five Societies Cooperate in National Metal Week. Wide Variety of Equipment Shown. Papers on Melting, Heat Treatment, Crystal Structure, Corrosion and Welding

THE Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers met in Boston, September 21-25, together with the other societies which were cooperating in what is now a regular annual function, National Metal Week. The meetings of the Institute were held at the Statler Hotel. They were well attended, the papers were their usual high grade and they were warmly discussed. Abstracts are given below.

Features of National Metal Week

The exhibition of metal products and metal working equipment was 50 per cent larger than in 1930. It covered 60,000 square feet in the Commonwealth Pier and included displays of almost every kind of steel and important non-ferrous metal and alloy.

The group of technical societies cooperating in the meetings and in the exhibits were, in addition to the Institute of Metals mentioned above, the American Society for Steel Treating, the Iron and Steel Division of the A.I.M.E., the American Society of Mechanical Engineers, the American Society of Automotive Engineers and the American Welding Society.



DR. C. H. MATHEWSON
Nominated for Chairman

Industrial Plant Visits

One of the features of the week was the arrangement for visits to industrial plants in and near Boston, among which were the Watertown Arsenal, Bethlehem Shipbuilding Corporation, General Electric Company River Works, and the Walworth Company.

Annual Fall Dinner

At the Dinner of the Institute of Metals Division a report was made of the financial condition of the Division which showed it to be excellent. The Institute's membership is also holding up well in spite of adverse conditions. After the Dinner a non-technical talk was given by Allan Kissock, vice-president of the Climax Molybdenum Company, describing the history and development of holybdenum production in the United States. Mr. Kissock illustrated his story with lantern slides and enlivened it with a number of excellent anecdotes which made the talk not only all the more interesting but also very pleasant.

New Secretary Elected

Announcement was made of the resignation of the secretary of the A.I.M.E., Dr. E. C. Bain, who will take the post of director of the Copper and Brass Research Association of New York. The new secretary of the A.I.M.E. is A. B. Parsons who has been Dr. Bain's assistant for several years. It is the plan of the Copper and Brass Research Association to put more of its efforts into research which has been somewhat neglected in the past, as the Association has devoted most of its energy to advertising and general publicity.

New Officers for Division Nominated

The nominating committee offered the following list as their choice to be elected at the New York meeting in February, 1932:

Chairman: Dr. C. H. Mathewson, Professor of Metallurgy, Hammond Laboratory, Yale University, New Haven, Conn.

Vice-Chairmen: W. A. Scheuch, Metallurgist, Western Electric Company, Hawthorne, Chicago, Ill.

T. S. Fuller, Metallurgist, Research Laboratory, General Electric Company, Schenectady, N. Y.

Secretary-Treasurer: W. M. Corse, Consulting Metallurgical Engineer, Washington, D. C.

Members of Executive Committee, to serve three years:

E. H. Dix, Metallurgist, Aluminum Research Laboratories, Aluminum Company of America, New Kensington, Pa.

J. W. Scott, Metallurgical Engineer, Western Electric Company, Hawthorne, Chicago, Ill.

E. M. Wise, Metallurgist, International Nickel Company, Bayonne, N. J.

W. A. SCHEUCH
Nominated for Vice-Chairman

T. S. FULLER
Nominated for Vice-Chairman

W. M. CORSE
Nominated for Secretary-Treasurer

Exhibits of Non-Ferrous Metal, Metal Products and Equipment

A list of the important exhibitors in the field of non-ferrous metals and products which they displayed follows:

Ajax Electrothermic Corporation, Trenton, N. J. Ajax-Northrup coreless induction furnaces for metal melting.

American Brass Company, Waterbury, Conn. Oxy-acetylene welding with Tobin bronze rods; Everdur metal, a copper-silicon-manganese alloy, in all forms.

American Electric Furnace Company, Boston, Mass. White metal and babbitt melting furnaces.

American Gas Association, New York. General information about the use of gas as a fuel in industry.

American Gas Furnace Company, Elizabeth, N. J. Gas fired metal melting and heat treating furnaces.

Armstrong Cork and Insulation Company, Lancaster, Pa. Insulating brick in various special shapes.

Botfield Refractories Company, Philadelphia, Pa. Fire brick cement; Adamant gun for applying refractory surfaces or coatings on old furnace linings.

Brown Instrument Company, Philadelphia, Pa. Pyrometers and recording instruments.

Carborundum Company, Niagara Falls, N. Y. Abrasive materials, grinding wheels, abrasive grain, abrasive discs; also a number of refractory materials.

Carborundum Company, Perth Amboy, N. J. Fire brick and high temperature cements.

Chromium Corporation of America, New York. Chromium plated products.

Dow Chemical Company, Midland, Mich. Magnesium-base Dow metal alloys; also representative castings, forgings, sheet, extruded products, etc.

Ford Company, J. B., Wyandotte, Mich. Samples of specialized cleaners for metal products of all kinds.

General Electric Company, Schenectady, N. Y. Industrial heating devices such as brazing furnaces, soldering irons, glue pots, immersion heaters, strip heaters, metal melting pots.

Industrial Welded Alloys, Inc., Newark, N. J. Schwab continuous melting machine for lead, tin, stereotype metal, aluminum, zinc, etc.

International Nickel Company, New York. Typical applications of nickel and nickel alloys.

Kemp Manufacturing Company, Baltimore, Md. Industrial carburetor for pre-mixing gas and air; metal melting as applied to soft metals.

Leeds and Northrup Company, Philadelphia, Pa. Pyrometers and recording instruments.

Madison Kipp Corporation, Madison, Wis. Automatic die casting machine and die casting department equipment.

Merrimac Chemical Company, Boston, Mass. Inhibitor acids for pickling.

National Electric Light Association, New York. Metal melting and heat treating furnaces.

New Jersey Zinc Company, New York. Zinc base die castings.

Newton Die Casting Company, New Haven, Conn. Zinc, aluminum, lead and tin base die castings.

Norton Company, Worcester, Mass. Grinding wheels, refractories, and high speed grinding machines.

Paul Maehler Company, Chicago, Ill. Gas fired, heat treating furnaces.

Process Engineering and Equipment Corporation, Attleboro, Mass. Electric furnaces for bright annealing.

Pyrometer Instrument Company, New York. Radiation pyrometers.

Ransohoff, Inc., N., Cincinnati, Ohio. Ideal acid star return descaling and pickling machine.

Roessler and Hasslacher Chemical Company, New York. Metal cyanides and chemicals used in electroplating and rust-proofing steel.

Surface Combustion Corporation, Toledo, Ohio. Metal melting furnaces.

Wilson-Mauelen, New York. Pyrometers and recording instruments.

Abstracts of Institute of Metals Division Papers

PREFERRED ORIENTATION PRODUCED BY COLD ROLLING IN THE SURFACE SHEETS OF ALUMINUM, NICKEL, COPPER AND SILVER

By Cleveland B. Hollabaugh and Wheeler P. Davey

Research Fellow, Hercules Powder Company and Professor of Physical Chemistry, The Pennsylvania State College, Respectively.

The preferred ranges of the crystal fragments in the surfaces of sheets of aluminum, nickel, copper and silver have been determined for a series of samples of each metal, with consecutively increasing number of passes through the rolls. The structures found in these metals were related, but not identical except in the case of nickel and copper which were identical in every respect. Aluminum was shown to be very sensitive to slight differences in rolling treatment. Nickel, copper and silver were shown to be comparatively insensitive, showing no differences with increasing number of passes through the rolls as far as limitation of the orientation ranges were concerned.

AGE-HARDENING COPPER-TITANIUM ALLOYS

By F. R. Hensel and E. I. Larsen

Research Laboratories, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

The age-hardening effects produced by the addition to copper of small amounts of titanium produce a large increase of the tensile properties. The proportional limit and the yield point are raised in some cases as much as 1,000 per cent, while the increase in hardness amounts to only 100 per cent. The increase in tensile strength is directly proportional to the increase of hardness and the decrease of elongation, but the elongation values are still high enough to make the alloy very desirable as a structural material.

RELATION OF CRYSTAL ORIENTATION TO BENDING QUALITIES OF A ROLLED ZINC ALLOY

By Gerald Edmunds and M. L. Fuller

Research Division, New Jersey Zinc Company, Palmerton, Pa.

The relation of crystal orientation to the bending properties of zinc, both pure and alloyed, has been considered in the light of the explanation generally accepted for the mechanism of the plastic deformation of zinc. It has been deduced that two types of orientation are unfavorable for the bending deformations; namely, basal planes (1) parallel or (2) perpendicular to a line normal to the axis of the bend and lying in the surface of the strip.

Experimentally, the first type of unfavorable orientation has been observed as a thin layer at the surface of strips in a rolled zinc alloy. Poor bending qualities were found whenever this orientation persisted to a depth of 0.0005 in. or more. Confirmation of this relationship has been obtained by determining the effect on bending properties of the removal by etching of the surface layer.

In addition, from a study of orientation beneath the surface, the cause of the better **across-grain** than **with-grain** bending properties has been determined.

SEASONAL VARIATION IN RATE OF IMPINGEMENT CORROSION

By Alan Morris

Research Engineer, Bridgeport Brass Company, Bridgeport, Conn.

Impingement attack, as one of the types of corrosion suffered by condenser tubes, has been given a prominent place in corrosion literature of recent years. The tests recorded here were undertaken in an effort to find at least some sort of qualitative answer to questions which arose occasionally as to the relative resistance of various alloys to impingement attack, and which could not be answered by reference to the literature.

In three years tests the increased corrosion was coincident with the period when the water gave off that unpleasant odor which is characteristic of such waters in warm weather. At the same time the external surfaces of the brass parts of the apparatus became covered with a black film. Qualitative tests of the water showed hydrogen sulfide.

INFLUENCE OF STRESS ON CORROSION

By D. J. McAdam, Jr.

Metallurgist, U. S. Bureau of Standards, Washington, D. C.

Special attention is given to nickel, aluminum bronze stainless iron, nitrided steel and Muntz metal. Each experiment was in two stages: (1) a corrosion stage, in which the specimen was corroded with or without cyclic stress; (2) a fatigue stage, in which the specimen was tested to fatigue failure and the fatigue limit was estimated. The lowering of the fatigue limit is used as a measure of the "damage" due to corrosion.

Diagrams of three types are presented: Type 5 illustrating relative influence of stressless corrosion

and corrosion under cyclic stresses, in causing damage; type 10 illustrating influence of cycle frequency on net-damage, and type 11a illustrating influence of stress range. These diagrams, in addition to diagrams for steels, aluminum alloys and monel metal presented in previous papers, illustrate the behavior of a great variety of metals under similar conditions of corrosion.

Preliminary data are given to illustrate influence of varying corrosion conditions on the forms of the net-damage diagrams. Influence of varying water composition and oxygen content, and influence of red-lead coating, are discussed.

The type 10 (frequency) diagram is probably of the same qualitative form for all metals and corrosion conditions, but the quantitative form and position vary. The form and position are influenced greatly by the properties of the coating whether of corrosion products or other material. The type 10 diagram also illustrates the relative influence of cyclic stress and steady stress.

The rate of net-damage varies as the third to at least the fifth power of the corrosion stress, depending on the metal, cycle frequency and corrosion conditions.

The general conditions favoring intercrystalline corrosion are discussed. Application of stress-corrosion data to design, construction and operation of machinery and structures is discussed briefly.

PREPARATION OF GRADED ABRASIVES FOR METALLOGRAPHIC POLISHING

By J. L. Rodda

Investigator, Metal Section, Research Division, New Jersey Zinc Company, Palmerton, Pa.

A method for producing uniformly sized abrasives for metallographic polishing has been described. The essential steps in the process are:

1. Thorough dispersion of the abrasive in water. This is accomplished by using a small amount of sodium silicate as a peptizing agent and dispersing in either a colloid mill or a pebble mill.
2. The abrasive suspension is allowed to settle for a definite time and siphoned off to a predetermined depth, using the siphoned material.

EFFECTS OF SECONDARY COPPER ON THE METAL MARKET

By Percy E. Barbour

Consulting Mining Engineer, New York

1. The figures of total production of secondary copper as published in statistics must not be used in reference to the copper market without segregation of figures of copper metal and figures of brass and other alloys.
2. A distinction should be made between secondary copper metal and "secondary copper" as is used in statistical tables, otherwise fantastic conclusions are inevitable.
3. Secondary copper metal only is the production of interest to the copper market and production of secondary or remelted brass has no more effect on the price of copper than as if the copper content were something else.
4. Secondary copper, either as metal or as content of brass and alloys, does affect the miner by supplying secondary metal where primary would otherwise be required.
5. Production of both secondary copper metal and remelted brass are functions mainly of primary production as governed by general business and are not functions of price, except at abnormal highs and then but briefly.
6. There is not a rapidly growing "revolving fund" of secondary copper that is going to be a Frankenstein to embarrass the copper industry, which could ill afford to have another.
7. The United States has always produced more copper than it has consumed. It has never used foreign copper, does not now, and there are no indications that it will have to do so.

SOME IMPORTANT FACTORS CONTROLLING THE CRYSTAL MACROSTRUCTURE OF COPPER WIRE BARS

L. H. DeWald

Metallurgical Engineer, Hawthorne Works, Western Electric Company, Inc., Chicago, Ill.

On the assumption that tough-pitch copper of the same ultimate chemical compositions produced under identical conditions is used, these general conclusions are drawn:

1. The crystal macrostructure of copper can be changed at will by varying certain casting conditions. Arranged in respect to their probable order of importance, they are: (1) initial temperature of the molten metal, (2) speed of pouring and (3) the mold temperature.
2. A fine equiaxed structure can be produced by a combination of casting conditions, including low casting temperature, low mold temperature and a decreased rate of casting. The converse is also true; that is, a coarser structure can be produced by increasing the mold temperature, molten metal temperature and increasing the speed of pouring.
3. The original crystal macrostructure of the as-cast wire bar does not change by preheating for hot rolling.

The 225-lb. experimental wire bars of fine and coarse crystal macrostructure, as well as some of the 70-lb. experimental bars, were processed through the Hawthorne rod and wire mill. No difference in commercial mill performance could be observed in drawing the bars of 24-gage wire at the standard drawing speeds.

However, tough-pitch copper produced at low temperatures has been found, in general, to be preferable for producing copper wire bars to be converted into fine wire, and since a fine crystal macrostructure of the molten copper is indicative of the use of low temperatures, those wire bars having this fine crystal macrostructure are considered preferable for wire-drawing purposes.

COPPER EMBRITTLEMENT

By L. L. Wyman

Research Laboratory, General Electric Company, Schenectady, New York.

It has been hoped that the results of these experiments might show a definite range of temperatures within the operating conditions, which might be particularly disadvantageous to copper, in general, and that the relative merits of these different materials might be definitely shown. The results show conclusively that:

1. There is no definite range within which copper in general, as represented by the materials at hand, is particularly susceptible to cracking.

2. The coppers used may be rated in the following order:

a. Zinc-deoxidized copper.
b. Silicon-deoxidized copper.
c. Calcium boride-deoxidized copper.
d. Vacuum copper.
e. Silicon and phosphorus-deoxidized copper.
f. Commercial copper.

3. Purified (vacuum) and deoxidized coppers are more resistant to cracking than commercial copper.
4. The extent of this resistance is dependent on the type of purification, and the kind of deoxidant utilized.
5. There is material variation between materials manufactured by the same process.

In addition, it may be stated that the manufacturing records are in complete accord with the results obtained, without exception.

THE BETA TO ALPHA TRANSFORMATION IN HOT-FORGED BRASS

By Robert S. Baker
Research Laboratory, The American Brass Company, Waterbury, Conn.

1. The transformation occurred in all cases in a forging from a rod containing approximately 60.3 per cent copper and 1.75 per cent lead.
2. The rod was heated above 800° C. before forging.
3. The die does not have to be cold to cause the transformation although a cold die would undoubtedly be more effective.

The transformation from beta to alpha is a matter of academic interest until it appears in a manufactured article. The rim of the original forging in which the transformation was noted was imperfectly formed. The flow of the metal into the die had been arrested and the presence of the transformed alpha gave a clue as to what had occurred. Corrective measures were devised and applied, resulting in perfect forgings.

SOME DEVELOPMENTS IN HIGH-TEMPERATURE ALLOYS IN THE NICKEL-COBALT-IRON SYSTEM

By C. R. Austin and G. P. Halliwell
Research Laboratories, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

The investigation described in this paper deals with the development of high temperature alloys of the Konel series. These alloys are essentially nickel-cobalt-iron, most of them containing titanium, about 2.5 per cent. The paper lists the alloys described, apparatus and procedure, the mechanical properties of the alloys. The aging characteristic as revealed by various time-temperature observations on the Vickers hardness tester, and the bend-test description and observations.

THE EQUILIBRIUM DIAGRAM OF THE COPPER-RICH COPPER-SILVER ALLOYS

By Cyril Stanley Smith and W. Earl Lindlief
Research Laboratory, American Brass Company, Waterbury, Conn.

The equilibrium diagram of the copper-silver system from 0 to 12 per cent silver has been redetermined. The liquidus agrees well with previous investigations, while the solid solubility determined by the microscopic examination of quenched samples was found to be 7.9 per cent at the eutectic temperature, 779.4° C. The solubility decreases rapidly below this point, becoming 4.4 per cent at 700°, 2.1 per cent at 600°, 0.90 per cent at 500° and about 0.4 per cent at 400° C. and below. This solubility curve is in good agreement with those recently published by Stockdale and by Ageew, Hansen and Sachs. The age-hardening which would be expected to result from this change in solubility was not realized, and there was actually a decrease in tensile strength caused by precipitation, although high electrical conductivities were obtained in alloys annealed at low temperatures.

LARGE WELDED EVERDUR PRESSURE VESSELS

By Marselis Powell and I. T. Hook
General Foreman, The Whitlock Coil Pipe Company and Research Engineer, The American Brass Company, Respectively.
A Paper Read Before the American Welding Society.

A metal having the general properties of copper has long been desired as a material for the manufacture of pressure vessels. Copper itself has been used to a limited extent, but its use has been greatly restricted due partly to its low strength and partly to fabricating difficulties attending its use. In Everdur we have a metal which has even better corrosion resistance than copper while it approximates the strength of mild boiler steel and, as measured by elongation, it has a ductility comparable to that of Swedish iron.

We have demonstrated in the foregoing that the material is readily welded, an excellent strength and ductility being attained by the procedure outlined. Fabrication by welding methods has been proved to be a practicable and economical method of construction while the design has been simplified greatly by the use of butt-welded seams. Finally, the pressure tests, more than usually severe for vessels of this type, showed results entirely satisfactory and wholly in harmony with results obtained on test samples.

Other papers on non-ferrous metals read before the American Welding Society were the following:

Welding of Copper and Brass Piping, by **H. V. Inskeep.** Linde Air Products Company.

Welding of Galvanized Steel, by **H. F. Reinhard, J. B. Colt Company.**

Foil from Oxidized Aluminum Slabs

Q.—We are rolling aluminum foil from ingots which are .020" in thickness, and find that after these ingots have stood awhile there is a certain amount of oxide which accumulates on the outer surface which has caused us considerable trouble in rolling. How can we clean this?

A.—The removal of aluminum oxide is an exceedingly difficult metallurgical operation, and in addition is somewhat ineffectual, even when the oxide is removed, due to the fact that a fresh oxide immediately forms, when the metal is exposed to bad atmospheric conditions.

Great care should be taken in selecting the place to store the metal, and the manner of piling same. A room subjected to rapid changes of temperatures or dampness from outside should be avoided.

You refer to "ingots," 0.020" in thickness. We are assuming that these are rolled slabs, and would suggest getting information from the source that produces the aluminum slabs, as in this process a pickling operation is necessary.

Information obtained from one of the large aluminum manufacturers on treating forgings of this metal for the removal of oxide, gives a dip for the metal, hot 4 per cent caustic soda solution; wash with water, and immerse in a solution of nitric acid, 6 to 10 per cent; wash thoroughly in water, and dry. If the drying operation is not complete the metal will quickly retarnish.—W. J. Pettis.

The Oxy-Acetylene Welding of Copper and Aluminum and Some of Their Alloys

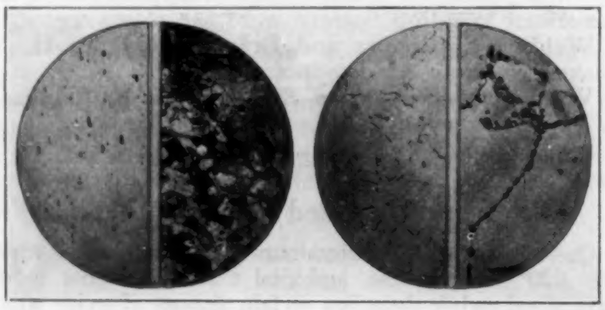
By FRANCIS A. WESTBROOK
Mechanical Engineer, New Canaan, Conn.

A Description of the Applications for Welding and Methods of Welding Various Alloys, Cast and Fabricated

Copper Suitable for Welding.

UNTIL recently, some difficulty was experienced in obtaining high strength welded joints in copper, not because the weld itself was weak, but because brittleness developed in a zone adjacent to the weld. The determination of the cause of this weakened zone and the development of methods to eliminate it constitute a most interesting instance of successful industrial research.

The presence of cuprous oxide was found to be the cause of the difficulty. Molten copper has the property of absorbing oxygen, part of which forms cuprous oxide; Figs. 1 and 2. Even extremely pure electrolytic copper, when melted and cast into ingots, acquires this impurity.



Figs. 1 and 2—Oxide specks scattered in metal before welding

Figs. 3 and 4—Separation of oxide to grain boundaries in metal adjacent to weld

Much, but not all, of the oxygen which the molten copper absorbs is removed by covering the molten copper with charcoal and stirring it with a green hardwood pole. The small amount of oxide remaining in ordinary commercial copper does not affect its properties for most uses, but it does affect the welding properties, for minute particles of oxide separate out along the grain boundaries when the copper cools. Since the oxide is brittle, the metal is weak along these lines. Rolling and reheating break up the original grain structure so that the particles of oxide are no longer at the grain boundaries; therefore, rolled sheet copper is strong. But when welding is done the heat causes a new separation of the oxide along the grain boundaries in a zone adjacent to the weld and makes this area weak; Figs. 3 and 4.

The cure for this difficulty is to secure, both for the base metal and the welding rod, copper that is free of oxide. Completely deoxidized copper, produced by adding a slight excess of silicon to the molten copper before casting, can now be obtained; Figs. 5 and 6.

To test the welding properties of a shipment of copper, a sample should be heated to a bright red and hammered on an anvil. To be suitable for high strength welds, it should not break. Brittleness due to the presence of oxide is at a maximum just below the melting point.

Generally speaking, the technique of welding deoxidized copper is about the same as that for steel. Because of the high heat conductivity of copper, the welding tip should be one or two sizes larger than that used for steel of the same thickness, and the work should be covered with large pieces of asbestos paper. Preheating to a dull red is always desirable. No flux is necessary.

Practical Applications

A practical application in the chemical industry will substantiate the foregoing discussion. A metal container for hydrofluoric acid was needed, and tests were made

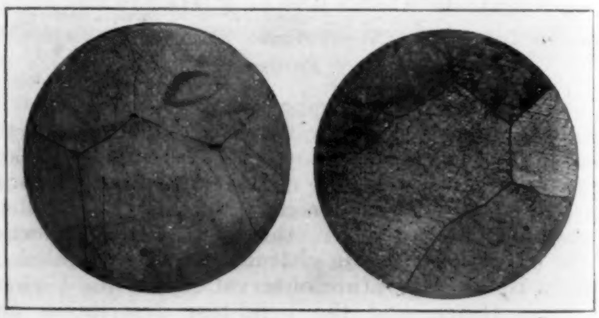


Fig. 5—Copper completely deoxidized with silicon shows no oxide specks

Fig. 6—Deoxidized sheet welded shows no oxide crystal separation

to determine the availability of deoxidized copper. Welded seams were desirable, of course. To determine whether a welded vessel would have the necessary strength to withstand bending and vibration, a preliminary test was made on a piece of the deoxidized copper sheet, using a machine which discloses the ductility of a specimen by pressing a metal ball into it until it cracks. The specimen of the base metal tested at 6,000 lb.; a weld, flattened by hammering, at 8,000 lb.; Figs. 7 and 8.

With this assurance of strength, the plant made the tank by ox-welding.

To repair copper vessels made of the ordinary commer-

cial copper used before the deoxidized product was developed, bronze-welding can be used to advantage. Repairs of this kind can be successfully made on copper cooling or heating coils, stills, and other equipment.

The technique for bronze-welding copper is very similar to that employed in bronze-welding steel or cast iron. The part should be held in a jig, heated to a dull red, and covered with a tinning layer of bronze. Brazo flux and a neutral flame will give the most satisfactory results. A high strength bronze-welding rod which has a low melting point should be used; this will obviate weakening the copper by excessive heating.

Copper Alloys

The best known commercial alloys of copper are the brasses and bronzes. Brass is distinguished by the presence of zinc in proportions of from 30 to 40 per cent; bronze, by the presence of tin—usually about 10 per cent, but varying from 8 to 25 per cent. Aluminum, phosphorus, nickel, iron, manganese, and lead may also be added to the copper alloys to give them certain desired properties. For instance, a small amount of lead (1½ per cent) added to brass makes it much easier to machine; and for bearings, as much as 25 per cent may be added.

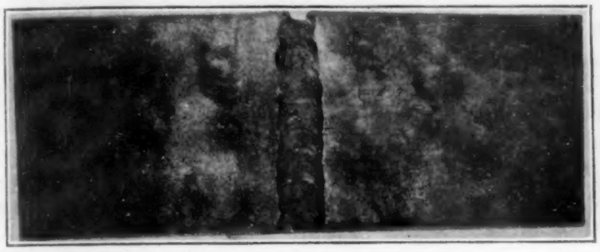


Fig. 7—Weld in copper, flattened for ductility test

Since there is an enormous number of such alloys in commercial use, and since it is impossible to tell the composition of any one of them without a chemical analysis, which seldom is practicable, it is impossible to give specific rules for the welding of each. Nevertheless, there are certain general principles which should be borne in mind.

Heat Embrittlement

Like copper, many of the copper alloys become weak and brittle when hot. This weakness, or the possibility of it, must be taken into account, especially in the welding of large pieces. Preheating to a dull red and covering the casting with asbestos paper during welding is helpful, but other precautions must be taken. Since the cooler zones may be weak enough to crack under the shrinkage stress, castings must be carefully handled while hot, and should be reheated after welding, and then be allowed to cool very slowly.

It is not necessary to use a larger blowpipe tip than that used for steel of the same thickness; the higher heat conductivity of the brasses and bronzes is offset by their lower melting point. Since the wide variety of alloys makes it impossible to obtain welding rods of exactly the same composition, standard bronze, manganese bronze, or drawn brass rods usually will be found to be satisfactory. However, in some cases, as where colors must be matched, it may be necessary to use special welding rods. Brazo flux should be used, but in small quantities to avoid porosity.

In welding brass, always work in a well-ventilated place. Molten brass gives off heavy white fumes of zinc oxide. These are not poisonous, but if inhaled for some time they will cause nausea.

The bearing brasses, which contain considerable amounts of lead, cannot be welded to produce high strength joints. The reason is interesting: Under the blowpipe flame, the lead separates from the copper, brass, or bronze as small molten drops which tend to sink to the bottom of the weld because they are heavier. Also, the low melting point of the lead frequently causes it to boil out and leave the weld porous.

Castings of Monel metal, the natural alloy of copper and nickel, must be preheated slowly; and, because Monel metal is very sensitive to sudden changes of temperature, the temperature must be maintained at 1,200 deg. F. (dull red) during the welding operation in order to avoid uneven heating strains. Like pure nickel, Monel metal is weak at high temperatures and should be carefully supported in the preheating furnace. The welding is done with a rod of Monel metal and with a neutral flame.

In welding Monel metal sheet, the operator should proceed continuously and rapidly to the end of the seam without lifting the blowpipe. It is essential that the joint be made correctly the first time; any attempts to reweld almost always result in cracking the seam.

Monel metal bars for forging should be preheated with the blowpipe until a small area either side of the vee is bright red. The beveled edges must be free of oxide or dirt. The two sides are fused together at the bottom of the vee by forming a puddle that extends about half way up the vee. After progressing about 2 in. in this manner, the operator should return to the beginning of the section and make the other half of the weld, taking particular care to fuse the upper and lower layers thoroughly. Advancing 2 in. at a time, the entire weld is made in this way. When a double vee is used, the whole piece should be reheated to a dull red when the first weld has been completed; then the welding should be started on the other side.

For welding rod, cold drawn Monel metal wire or strips cut from sheet can be used. Flux is seldom required. Welds should be built up well above the surface of the base metal. This permits grinding, which removes slag and impurities and leaves only sound metal in the weld.

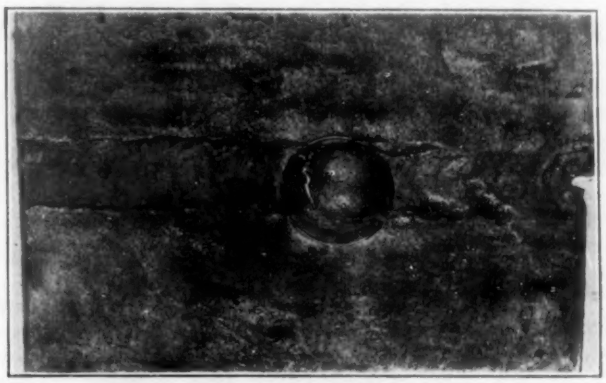


Fig. 8—Weld Tested at 8,000 lbs.

From the foregoing, it is evident that all copper alloys except brasses which contain lead are easily weldable when the proper technique is used. When the welding of these alloys is a regular production operation, it will pay to make a preliminary investigation as to the most efficient procedure to employ. For repair work, however, satisfactory results can be obtained by following the ideas outlined above.

This article will be concluded in an early issue.—Ed.

British Institute of Metals Meeting

Synopses of Papers Presented at the Twenty-Fourth Annual Autumn Meeting Held in Zürich, Switzerland, September 13, 15, 1931, and Brief Summary of the Meeting.

THE twenty-fourth Annual Autumn Meeting of the Institute of Metals took place, by kind invitation of the Schweizerische Verband für Materialprüfung (Swiss Association for Testing Materials), in Zürich, from September 13-15, and was attended by over 200 members from 15 different countries. The meeting began in the evening of September 13, with an official welcome, in the Eidgenössische Technische Hochschule, by representatives of the inviting body and of the town and Canton of Zürich, and was followed by the Tenth Autumn Lecture, delivered by Ulick R. Evans, M.A., on "Thin Films in Relation to Corrosion Problems." During the mornings of the two following days, September 14 and 15, there were presented for discussion the 25 original communications of which summaries are given below. The afternoons of these two days were devoted to visits to works, and the evenings to social gatherings. At the conclusion of the two-day meeting in Zürich the members made a series of short tours in Switzerland, visiting the Rigi, Lucerne, Interlaken, Thun and Chippis-Siders, at both of which latter places metal works were visited. A visit was also paid to Bienne, where members visited a watch factory. Before returning home a party of members proceeded to Milan for the International Foundry Exhibition and Congress.

Papers Read

Tenth Autumn Lecture, by U. R. Evans, on "Thin Films in Relation to Corrosion Problems."

To discuss corrosion in Zürich is appropriate; first because the cleanliness of the industrial quarter of Zürich affords support for the view that a foul, corrosive atmosphere is not the necessary accompaniment of industry; and secondly because very important researches on the subject have been carried out in Zürich by von Wurstemberger, Honegger, Köhlschütter and others.

The thin oxide-films, which are responsible for the apparent stability of such metals as aluminium and stainless steel, are usually too thin to give interference tints; they are invisible whilst in contact with the metallic basis, but are perfectly visible when removed from it. Although the films produced by air alone give some protection, the stability can be increased by special treatment with oxidizing agents. The slightly thicker films produced on heating in air give rise to beautiful interference tints (such as the temper-colors on iron); but they tend to crack and have usually little protective value.

Almost all methods of removing a film—whether an "invisible" film or a film thick enough to produce an interference tint—depend on some treatment which will dissolve the metal immediately below, thus allowing the film to peel off. For films on aluminium, nitric acid or gaseous hydrogen chloride has been used; for iron, a solution of iodine; for other metals, anodic treatment in a chloride or sulphate solution. It is sometimes possible to transfer the film to glass or cellophane, and the films responsible for heat tints often show tints even after removal to the transparent support.

Although certain additions to metals (especially those which pass into solid solution) increase the resistance, impurities present as a second phase often increase the tendency for a breakdown of the film to extend, thus increasing the total destruction (although sometimes rendering the attack to be less localized and hence less intense).

Most natural oxide-films are not wholly impervious to ions; they contain weak points. To be useful they must be "self-healing"; in other words, the secondary corrosion-product must be precipitated so close to the weak points in the film, as automatically to seal the defect. The movement of electrode potential with time provides a valuable method of observing whether, in any particular case, the weak points are healing up or are extending. Such methods have been used to demonstrate the self-healing qualities of the film present on the new brass containing aluminium, which is now being used with success for condenser tubes; they can also be applied to the comparison of various steels containing chromium and/or nickel, under different conditions of heat-treatment and surface-treatment. A corrosion-product can only be protective, if produced very close to the metal. Lead resists a sulphate solution, but not a nitrate solution; galvanized iron resists small drops of salt water better than large drops. When part of the surface of an immersed metallic specimen is "screened" from oxygen, any weak points on the screened area will tend to develop, whilst on the "well aerated" part they will tend to heal up; foreign bodies lodging in condenser tubes often cause local attack, probably as a result of their screening action. When the concentration of oxygen (or oxidizing agent) remains fairly uniform, the water-line is the weakest place; an aluminium sheet introduced vertically into a chloride solution is mainly attacked along the water line and at the cut edges. Under conditions where metal is continually bent, or abraded, or bombarded by air bubbles, whilst in contact with a corrosive solution the mechanical erosion will often prevent self-heating, and corrosion will then continue; likewise the combination of alternating stresses and corrosive influences causes dam-

age far more rapidly than either alternating stresses or corrosive influences acting alone. Such cases cannot be explained on purely mechanical or purely chemical principles; both influences must be taken into consideration; consequently a greater collaboration between engineer and chemist is called for than has been obtained hitherto.

"The Effects of Cold-Rolling and of Heat-Treatment on Some Lead Alloys," by H. Waterhouse and R. Willows.

The effects of cold-rolling, heat-treatment, and storage on the Brinell hardness of 14 lead alloys containing small additions of tin, cadmium and antimony have been studied. The hardness numbers of the cast alloys ranged from 5 to 18 Brinell. Cold-rolling hardened the soft alloys and softened the hard alloys, the hardness immediately after cold-rolling lying in all cases between 8 and 11 Brinell. Self-annealing at atmospheric temperature further reduced the hardness to about 7 Brinell.

Most of the alloys, especially those containing cadmium and antimony, were re-hardened to approximately the "as cast" hardness by suitable heat-treatment, quenching and ageing. Certain alloys age-hardened after air-cooling or even more restrained cooling from the heat-treatment temperature. The age-hardness persists for several months at least, but is destroyed by severe cold-working and self-annealing. The hardness of the harder alloys "as cast" is largely due to age-hardening. An alloy containing 1.5 per cent cadmium and 0.5 per cent antimony is particularly susceptible to age-hardening.

"The Protection of Magnesium Alloys Against Corrosion," by H. Sutton and L. F. Le Brocq.

The various methods of protecting magnesium alloys against corrosion are considered. Of the methods examined the most promising appeared to be that of chemical treatment of the surface followed by the application of lanolin or a suitable enamel. Two chemical processes have been developed which afford very fair protection, viz., (1) Immersion for six hours in a bath containing 1½ per cent potassium dichromate, 1 per cent alum and ½ per cent caustic soda, the bath being maintained at 95° C. (2) Immersion under the same conditions in a bath containing 1½ per cent potassium dichromate and 1½ per cent sodium sulphate (decahydrate).

For surfaces which are in the "as cast" condition a preliminary cleaning treatment in 10 per cent nitric aid is necessary, but for parts machined to fine tolerances this method is too drastic. In such cases a solution of 2 per cent caustic soda is used. Sand-blasting as a preliminary treatment is not recommended.

"Nickel-Copper Alloys of High Elastic Limit," by D. G. Jones, L. B. Pfeil and W. T. Griffiths.

The investigation was undertaken primarily in order to obtain reliable values for the elastic limit of nickel-copper alloys containing up to 50 per cent of nickel, but determinations were also made of maximum stress, elongation, and reduction in area. It was found that the elastic limit is low in substantially pure nickel-copper alloys in the fully annealed and in the cold-drawn conditions, but that high elastic limits are developed in all compositions as a result of low-temperature heat-treatment following cold-working. High elastic limits may also be produced in nickel-copper alloys containing small amounts of such elements as silicon, which render the alloys susceptible to heat-treatment.

By a combination of the effect of cold-work and low-temperature heat-treatment with the effect of precipitation hardening, high elastic limit material may be produced with greater facility than by either method alone, whilst good combinations of mechanical properties may be developed by suitable compositions and treatment. With higher contents of silicon a certain amount of difficulty is met with in some production operations, but even with less than 0.25 per cent silicon exceptionally good properties can be obtained, and the alloys of this composition present no difficulty in manufacture.

"Unsoundness in Aluminium Sand-Castings." Part I.—"Pinholes: Their Causes and Prevention," by Professor D. Hanson and I. G. Slater.

The presence of water vapor in contact with molten aluminium or its alloys leads to the production of "pin-holes" in sand-castings of the metal.

A comparison has been made of various methods of treating the molten metal prior to casting with a view to eliminating such pin-holes; the methods investigated include some previously proposed by other workers, as well as a number not previously used. Treatment with nitrogen or with chlorine is sometimes successful, but cannote always be relied upon to produce castings perfectly free from pin-holes; titanium tetrachloride is effective with "Y"-alloy, but was found to be less certain with other alloys, although the grain-refinement which it produces may make the pin-holes very small without reducing the total volume of the cavities. The most generally successful method was found to be treatment with a mixture of equal parts of nitrogen and chlorine, by means of which all the alloys examined could be made practically sound by a treatment of 20 minutes duration at 700°C. 60 lb. melts of "3L11" alloy were successfully treated at 730°-750°C. on a works scale, but difficulties were experienced with 300-lb. melts of "3L11" and "2L5." The success of all gas treatments depends on the temperature of the molten metal; just above the liquidus most of the methods proposed are very effective, but if the temperature of the metal is much above 700°C. it is doubtful if any method so far proposed can be relied upon to give successful results.

Treatment with volatile constituents such as sulphur, selenium, tellurium and cadmium has been tried, with varying results. Superheating "2L5" alloy to 950°C., prior to casting at normal temperature greatly reduced the number of pin-holes.

"Unsoundness in Aluminium Sand-Castings." Part II.—The Effects of Using Metal Previously Subjected to Corrosive Conditions," by Professor D. Hanson and I. G. Slater.

It is found that virgin aluminium after exposure to suitable corrosive conditions, and subsequently sand-cast, is unsound and contains pin-holes. Alloys of aluminium including "3L11" "2L5," "Y" and 12 per cent silicon show a similar phenomenon. The extent and amount of unsoundness which is produced depends upon the type and time of exposure, and also upon the particular alloy examined.

The suggestion is made that the deterioration is the result of eletrolytic action on corrosion, involving the liberation of hydrogen in the nasent state which is absorbed by the metal. On remelting and casting, the hydrogen is evolved in the molecular condition and produces pinholes.

"Applications of the Electric Furnace for Non-Ferrous Metals, with Special Reference to the Bright Annealing Process," by H. C. Kloninger, G. Keller and H. Meuche.

In this paper are briefly described the main types of furnaces used today for the bright annealing process. It is shown that during the past few years considerable improvements have been made in the quality of the product as well as in simplifying the handling of the annealed metals.

"The Marco-Etching of Aluminium-Silicon Alloys," by William Hume-Rothery.

The macrostructure of aluminium-silicon alloys can be revealed satisfactorily by means of a solution of cupric chloride containing from 150 to 160 grm. per litre. Etching is carried out by immersing the specimen several times in the copper-chloride solution, the deposit of copper being removed between each immersion. A final brightening can be obtained by treatment with a dilute solution of chromic acid. The preparation of the specimen, and the details of the etching process are described, and have been tested for alloys containing 5, 10, and 11 per cent of silicon respectively.

"Note on the Failure of a High-Strength Brass," by J. E. Newson and A. Wragg.

Experiments have been undertaken to indicate the source and cause of some isolated cases of failure observed in bars of high-strength brass. It has been determined that the reeling process for straightening, after extrusion, in the case of a brass with a high yield-point, is responsible for residual stresses of such an order, that failure due to internal cracking may result during storage, or on subsequent machining. The stresses are tensional, decreasing in intensity from the centre of the bar to the circumference.

Suitable low temperature annealing treatment effectively removes all possibility of residual stress cracking.

"The Constitution of the Alloys of Silver and Mercury," by A. J. Murphy, with an Appendix on The X-Ray Examination of the System Silver-Mercury," by G. D. Preston.

The constitution of the alloys of silver and mercury has been determined over a range of temperature extending from the melting point of silver to —50°C. Progressive additions of mercury to silver cause a continual reduction in the temperature of the initial freezing point down to—38.8°C., the freezing point of mercury. No alloy in the series has a freezing point lower than that of pure mercury. Silver can retain in solid solution 55 per cent by weight of mercury at 276°C., the amount probably increasing somewhat at lower temperatures. Two intermediate phases of restricted composition are formed. The β-phase contains 40 per cent of silver and dissociates on heating at 276° C. into α and liquid. This phase has a close-packed hexagonal lattice in which $a = 2.98$ Å and axial ratio $c = 1.62$. The γ phase contains 29-30 per cent of silver, and dissociates on heating at 127°C. into β and liquid; it has a body-centred cubic lattice, with side 10.0 Å.

The experimental methods devised for the investigation are described, and the effect of pressure on the constitution of the amalgams is discussed.

"Influence of Variations in Heat-Treatment and Ageing on Duralumin," by Professor A. von Zeerleder.

Experiments have been made, showing the influence of the temperature of the quenching liquid and the temperature of ageing on the physical properties of Duralumin (Avional). It is stated that quenching in hot water or in oil causes less deformation and that if the temperature of the quenching medium, as well as the ageing temperature, be 50°C., they have no disadvantageous influence on the physical properties. On the contrary, measurements of the electrochemical potential, electrical condutivity, tensile and corrosion properties showed that a temperature of 145°C. (293° F.) had a decidedly disadvantageous influence. A possible explanation for this phenomenon is to be found in the effect of different annealing temperatures on the potential of aluminium-copper alloys. Finally the cooling of sheet packets is examined during the period between being taken out of the furnace and quenched.

"Experiments in Wire-Drawing. Part I.—Behaviour of a Composite Rod," by W. E. Alkins and W. Cartwright.

Composite round rods of annealed copper built up by drawing a number of tubular layers of equal thickness over a central solid core have been drawn in drafts of varying severity through straight-sided dies of three different angles of taper. It has been found that butt ends when drawn through the dies become concave without showing any steps between the layers; the concavity increases with the angle of taper of the die and also with the amount of reduction at the draft. It has been shown that all the layers undergo a proportionate reduction in thickness and therefore the same relative reduction in area of cross-section.

The boundary surfaces between successive layers which are cylindrical in form both before and after drawing, assume in the reduction zone the form of surfaces of frusta of a series of cones of common axis and common apex; the apex of these cones is identical with that of the cone defined by the bearing of the die. The more nearly the individual layers lie to the centre of the rod the further back from the emergent side of the die is reduction found to commence and to finish. The loci of incipient reduction, of equivalent stages of reduction and of completed reduction are a series of spherical caps, radially paral'el to one another and bounded by the bearing of the die, all of which have a common centre at the apex of the cone, the surface of a frustum of which forms the bearing of the die. Reduction thus appears to be effected by pure sheer stress.

It is suggested that the behaviour of these composite rods is exactly comparable with that of solid round rods under similar conditions.

"The Drawing of Non-Ferrous Wires," by E. L. Francis and Professor F. C. Thompson.

The power required to draw wire is shown to be directly proportional to the maximum stress of the original material. With tungsten carbide dies, the pull required is shown to be practically independent of the speed of drawing over a wide range. A comparison is made between the efficiency of steel, carbide and diamond dies. Further proof is advanced that the power requirements are directly proportional to the reduction of area. The influence of the angle and contour of the die is investigated under various conditions. The problem of lubrication is discussed and an attempt made to estimate the coefficient of friction between the wire and the die.

"Application of the Spectrograph to the Analysis of Non-Ferrous Metals and Alloys," by H. W. Brownsdon and E. H. S. Van Someren.

The value of the spectrograph for the detection and estimation of small quantities of impurities and minor constituents in metals and alloys does not appear to be fully appreciated by chemists and metallurgists, and some reasons for the slow development of spectrographic methods of examination are suggested. The spectrograph is considered as an essential part of the equipment of a metallurgical laboratory. The possibilities and limitations of spectrographic methods are reviewed. Methods for the routine spectrographic examination of brass and some lead alloys are outlined and tables are given indicating the relationship between impurity or minor constituent concentration and relative line intensities.

This report will be concluded in our next issue.—Ed.

Retinning Milk Cans

Q.—WHERE can we obtain information as to what tools to use and how to handle 10 gal. milk cans (which are welded and do not come apart), and also 5 gal. ice cream freezers, when retinning, using the hot dip process?

A.—Ten-gallon milk cans and five-gallon ice cream cans are very difficult to retin. The first thing of importance is to have the can very thoroughly cleaned by putting it through a good cleaning solution. The cleaning solution should be kept at about the boiling point, and after all grease is thoroughly removed, the can should be washed in a clean boiling water bath.

After cleaning, the cans are then pickled in muriatic acid if they have rust spots on them. If the spots are bad, the best way is to put them in the acid overnight. Moderate rust spots can be removed with cold acid, but sometimes the very bad rust takes warm acid and a wire brush, as it is almost insoluble and very hard to remove. After pickling, the can is rinsed thoroughly in clean water.

The cans being now perfectly clean and all rust pickled off, they are ready for retinning. The next step is to put them into a tank of tinning flux. An important feature here is not to allow the can to stand on the drain rack too long as the flux dries or runs off, and a poor coating will be the result. Each can should be put into the tin bath as soon as the excess flux has run off.

The best kind of tongs to handle cans without the bottoms or tops off, that is welded one piece articles are large tongs with duck bill jaws. The jaws are about 4 inches from the hinge of the tong. They are made of $\frac{5}{16}$ inch to ⅜ inch round stock. The cans are rolled over and handled in the tin pot with this type of tongs. For putting the cans and freezers in the bath, the best method is to use a small block and tackle fastened to a hook directly over the tin bath. On the one end of the rope is a small pincer pair tongs something like ice tongs, but with a shorter grip and longer handles. The handles of the tongs have eyes in the ends so that ropes can be tied onto them. When the pincer jaws of the tongs are open the space forms a diamond shape, and when the rope is tightened this pulls both smaller ropes in the handles which in turn gives the pincer jaws the grip on the rim of the can, or top, or wherever it is most convenient to take hold.

The cans may be slowly pushed into the bath with a hook poker; that is, of course, if the tin has a tendency to spatter. A good liquid flux on the bath will help to lessen this trouble. The can is slowly pushed under the bath and caught with the tongs, rolled around to be sure the entire can is coated and the seams are filled. Then it is pulled up so that the tongs can be again caught in the bottom seam and the top held with the hand tongs so that the nose will be open to the air. This avoids suction effects. The can is then slowly pulled out of the metal bath with the rope pulley and at the same time the bath is skimmed clear of flux so that the coating will be clean and uniform. The bottom end is gradually raised until the last end of the can is fully drained and then the can is swung over away from the tin pot back to a drain rack which will tip the can so it will drain to one end edge for the last drip. If the seams are not filled properly then the can should be stood upright when it is withdrawn and the excess metal allowed to run back down the sides of the can into the seams. Good Straits tin should be used.

The cans and freezers are then taken into the soldering room and any open seams soldered and the drip removed from the neck. After soldering, the can is again put through the cleaner, rinsed well, dried and wiped with a dry cloth. It is then ready for delivery.—W. G. IMHOFF.

Thallium Metal Finding New Applications

NEW commercial uses for mallium, a comparatively rare metal which resembles lead, are reported in a recent publication of the Bureau of Mines, United States Department of Commerce, Washington, D. C. The resemblence to lead, along with its scarcity, has tended to retard the use of thallium, it is stated, but in the past few years it has been applied in a number of fields and further uses are being found for it. Its chief application has been in the manufacture of poisons for rats and ants. Alice V. Petar, who wrote the report on it, states that the physical and chemical properties of thallium are very similar to those of lead. The metal is white, with a bluish-gray tinge, somewhat paler than lead. It has a bright metallic luster when freshly cut, but dulls quickly when exposed to air. Thallium is softer than lead; it can be scratched by the finger nail and is easily cut with a knife. It is malleable, but has little tenacity, and can be squeezed but not drawn into wire.

There are no commercial ores of thallium, although it is present in small quantities in a great many minerals. The supply was formerly obtained solely from flue dusts that accumulated in sulphuric acid plants where pyrite is used. The thallium content of these flue dusts is small —usually about half of 1 per cent—and the thallium is produced only as a by-product. At present most of the domestic supply is a by-product of the purification of cadmium, itself a by-product of the smelting of other metals.

Alloys of lead and thallium are somewhat unusual in that they have higher melting points than either of the component metals; they are used in rather small quantities in special types of electrical fuses. An alloy containing 10 per cent thallium, 20 per cent tin and 70 per cent lead is resistant to the corrosive action of mixtures of sulphuric, nitric and hydrochloric acids. This alloy has been recommended for use as an anode for the electrolytic deposition of copper, since its corrosion is less than one-fifth that of lead alone. Experiments indicate that the addition of thallium to lead-base alloys markedly improves their resistance to deformation.

Further details are given in Information Circular 6453, which may be obtained from the United States Bureau of Mines, Department of Commerce, Washington, D. C.

Chromium Plating's Largest Field Is Industrial

Discussion of a Question of Great Importance to the Electroplating Industry and other Lines of Business

TO the Editor of THE METAL INDUSTRY:

We have read your editorial on "Plated vs. Solid Metals" in your September issue (Page 399) with much interest, but it occurs to us that you are placing too much stress on chrome plating as a non-tarnishing, decorative coat and leaving unsaid too much about chrome plating for industrial requirements, such as protection against wear, etc.

Within our experience as the oldest commercial chromium plating, service plant in the United States, chrome plating finds its most valuable applications and broadest needs on dies, molds, machine parts, etc., regardless of the materials they are made of. In many cases machine steel chrome plated gives longer life and other more satisfactory results than the hardest metals such products and parts can be made of, and at a great saving in cost.

The enclosed condensed reports will illustrate our point.

We have always regarded decorative chrome plating merely a luxury by comparison.

VACUUM CAN COMPANY,
Chicago, Ill.

Chromium Plating Is Revolutionary

Remarkable Physical Properties of Chromium as a Metal and As a Plating When Scientifically Deposited

It will not rust. It protects any base metal against rust if completely plated, without pores or cracks.

It protects against most forms of corrosion.

It is not effected by intense heat. Its melting point is 2,930° F. and retains its bright surface up to 1,200° F.

It protects base metals against scaling in heat.

Its heat conductivity (with silver at 100) is 50.

Its electrical conductivity (with silver at 100) is 57.

It is super-hard. Ryberg's and Moh's scales rate its hardness at 9 as compared to the diamond at 10, iron at 4.5, and nickel 3.5.

It is file hard in usual industrial platings.

It is very stable and retains its hardness at extremely high temperature.

It can be applied of sufficient thickness to make practicable the building up and recovering of tools otherwise valueless.

It gives long wearing life to products necessarily made of soft metals such as electros, printing rolls, type slugs, etc.

It is extremely smooth as a plating. It has the lowest coefficient of friction available in any of the structural metals.

Its lineal expansion per unit of length per degree centigrade is .0000067.

It has flexibility in thin deposits which permits valuable use on springs and like products.

It has an affinity for oil.

It resists wear.

It resists abrasion.

It resists erosion.

It does not pit, scale, peel, crack or blister in any service to which it is intelligently adopted.

It will not tarnish, stain or dim if kept clean and requires no polishing.

It resists most acids. Only hydrochloric and sulphuric acids have any effect on it.

It is not affected by organic chemicals, or alkalies, either hot or cold, dilute or concentrated.

It is particularly effective against sulphur and sulphur compounds encountered in the oil industry.

It is not affected by molten tin, zinc, brass or aluminum.

It resists the formation of verdigris on copper or brass.

It can be produced in dull, satin, bright and high lustre finishes.

It has a richer and more permanent decorative lustre than silver or nickel.

Its reflectivity is excelled only by newly plated silver.

It affords an absolutely clean surface which gives off no black oxide.

It is non-toxic and may be used in contact with food products.

It does not stick to plastic substances, such as rubber, bakelite, etc.

It does not affect the temper of base metals.

It is non-magnetic but does not affect magnetism of base metals.

It does not perceptibly change weight or dimensions of articles plated.

It does not obliterate markings, trade names, etc.

It has lubricating value.

It can be applied to all metals, most alloys and aluminum, though the latter is an art in itself.

It plates over soldered and welded parts.

It often makes possible the use of base metals that are cheaper and more easily fabricated.

It permits the use of any base metal you prefer.

Actual Experiences with Chromium Plated Equipment and Products

Reported by Customers of the Vacuum Can Company and Licensees of Affiliated Companies

(1) **Plug Gauges.**
Used 10,000 times as compared to usual service of 1,000.
(2) **Rotary Files.**
In constant service for over one year and still good.
(3) **Clutch Levers.**
Save service of 100,000 to 110,000 engagements, over twice usual life.
(4) **Molding Core Pins.**
Outlasted water-hardened pins and still operating.
(5) **Movie Camera Scraper Plates and Shutters.**
Increased life 200 per cent to 400 per cent.
(6) **Mandrels for Forming Chains.**
Permitted use of soft surface steel without qualding, reduced breakage and increased life.
(7) **Water Meter Parts.**
Increased service 400 per cent and still operating.
(8) **Oil Pipe Line.**
Reduced power required for pumping oil two-thirds.
(9) **Sealing Shoes for Packaging Chewing Gum.**
Prevented wax sticking and increased production.
(10) **Copper Drums for Photostat Work.**
Afforded protection against hypo solution and increased life.
(11) **Laboratory Cups for Testing Purposes.**
Made of cheap metal and chrome plated served nearly all the same requirements as platinum cups costing over $100 each.
(12) **Springs for Injection Pumps.**
Gave protection against crude fuel oils used on Diesel engines.
(13) **Binder Hooks for Threshing Machines.**
Gave six months' service as compared to normal service of six weeks.
(14) **Planing Knives.**
Increased life 100 per cent to 800 per cent and increased production.
(15) **Large Power Knives for Cutting Hard Rubber.**
Increased life and required sharpening less often.
(16) **Electric Railway Pantograph Strips.**
Gave 16,000 miles of service compared to normal service of 9,000 miles.
(17) **Ironing Shoes, Made of Steel.**
Gave service over 360 hours as compared to 48 hours for nickel plated shoes.
(18) **Aluminum Pistons.**
Stood heat test of 800° F. and plunging into cold water without cracking or peeling.
(19) **Files Used on Brass Castings.**
Lasted three times as long as unplated files.
(20) **Mixing Mills and Cellulose and Rubber Products.**
Prevented chemical reaction and made possible milling of products theretofore impossible.
(21) **Electrotypes.**
Increased life 7 to 15 times, eliminated filling of type, improved inking conditions, gave clearer impression, eliminated shutting down presses for plate repairs and reduced labor costs.
(22) **Marine Crank Shafts.**
Clearance increased by wear only .0002" as compared to normal wear of .0015".
(23) **Float Valve Needles.**
Those made of bronze, chrome plated gave service 2,500 hours, without showing wear or leak as compared to 650 hours for those made of stainless steel and 250 hours for those made of Monel.
(24) **Ham Retainers.**
Increased service, eliminated dissolution of product and simplified cleaning.
(25) **Airplane Carburetor Shafts** (Brass).
Reduced cost and produced four million revolutions without showing loss.
(26) **Welding and Soldering Iron Tips.**
Gave protection against heat sufficiently to greatly prolong life.
(27) **Battery Box Plates and Strippers.**
Increased life and improved product.
(28) **Automobile Radiator Shell.**
Stood 136 hours salt spray test without breaking down as compared to 6½ hours for nickel.
(29) **Motor Boat Shafts and Bearings.**
Operated three weeks, without lubrication, without apparent heating and very little wear.
(30) **Button Drawing Dies.**
Increased life over 50 times, prevented sticking and eliminated use of oil.
(31) **Spoon Drawing Dies.**
Increased life 400 per cent.
(32) **Swedging Dies.**
Increased life 200 per cent and still operating.
(33) **Embossing Dies.**
Increased life 300 percent and still operating.
(34) **Tube and Wire Drawing Dies.**
For copper, steel or nickel or for stamping out sheet metal parts from same materials produce from 2 to 150 times more service.
(35) **Dies for Forming Tools and Large Pressure Apparatus Fittings.**
Their resistance to high temperature and erosion caused by the flow of metals increased their life many times.
(36) **Drawing Dies for Waffle and Electric Irons, Etc.**
Increased service and produced more finished products.
(37) **Flanging Dies.**
Prevented materials sticking and improved products.
(38) **Bakelite Molding Dies.**
Increased life and more finished products.
(39) **Evaporator Tubes** (Paper Mill Industry).
Gave continuous service for nearly four years and showed no effect from contact with caustic and sulphite solutions, at a cost about one-half that of stainless steel tubes.
(40) **Embossing Rolls.**
Produced 18,000 reams of paper and still operating as compared to a normal production of 3,000—an increase of 500 per cent.
(41) **Printing Rolls.**
Produced 300,000 pounds and still operating as compared to normal production of 50,000 pounds.
(42) **Wall Paper Rolls** (Copper).
Greatly increased life and reduced expense of re-engraving.
(43) **Forming or Beading Rolls for Pie Tins.**
Permitted use of machine steel in place of tool and special steels, thereby effecting savings in materials

alone of $300 per set of rolls and at the same time increased the life of the rolls 1,000 per cent and improved operating conditions.

(44) **Bottle Molds.**
Produced brighter and smoother product.

(45) **Piston Rods.**
Used in large Diesel engines for marine service, show little wear after 100,000 miles service and reduced lubrication costs.

(46) **Wrist Pins, Piston Water Service Tubes, Exhaust Valve Stems, Crank Pins, Compressor Piston Rods, etc.**
Used in Diesel and gas engines, improved service, gave maximum wear, prevented corrosion and overcame lubrication difficulties.

(47) **Steel Liners in Slush Pumps.**
Used in certain oil fields, give six to ten months' service instead of usual two weeks' service.

(48) **Steel Pump Plungers.**
Used by a large pipe line company showed no measurable wear after 12 months' continuous service and are estimated to have effective life of 10 years. They also ran cooler and required practically no packing

(49) **Plungers for Hot Oil Pumps.**
Have given a year's service without costly shut downs and eliminated packing and plunger wear trouble.

(50) **Shafts or Sleeves and Balancing Units.**
For centrifugal pumps, protect against abrasion, and reduce wear and lubrication troubles.

(51) **Steam Turbine Blades.**
Give resistance to erosion not obtainable by any other metal or alloy.

(52) **Lathe Shafts.**
Reduced bearing losses more than any other combination of metals in plain bearings.

(53) **Expensive Shafts, Piston Rods, Etc.**
Which have been machined or worn undersize are being recovered, saving thousands of dollars to machinery builders.

(54) **Press Platens.**
Used in leather industry has resulted in a remarkable increase in resistance to wear and corrosion and an improved product.

(55) **Plug, Ring and Thread Gauges.**
Have a life 10 to 15 times longer than hardened unplated gauges and may be replated when worn through.

(56) **Huge Pressure Stills** (10 ft. in diameter by 40 ft. high).
Used in California oil refinery have been fully protected against corrosion for two years. Normal corrosion of iron vessels under exactly similar conditions is 1¼ inches for the same time.

(57) **Equipment for Manufacture of Glass, Enamel Ware, Hard Rubber, Die Casting and Electric Batteries.**
Have effected many economies on account of heat resistance.

(58) **Bearing Surfaces.**
Results in reduced lubrication, power and packing costs due to low coefficient of friction and adherence of oil.

(59) **Paper Mill Screen Plates.**
Show no apparent wear after 21 months' service and required little cleaning.

(60) **Suction Box Covers.**
Used in paper mill industry, indicated no wear in 12 months.

(61) **Automatic Can Making Machinery Parts.**
Their smoothness permits easy cleaning and reduces rejected products.

(62) **Springs (Steel) Used in Diesel Engines.**
Gave successful service in contact with sulphur encountered in crude oils used in Diesel engines.

Cadmium on Cooking Utensils

Q.—WE would like to know what position the state laws of New York take with regard to the use of cadmium plate on cooking utensils or around food products.

Cadmium, as you no doubt know, is plated from a cyanide solution. The plated article after three or four rinses is then dried and buffed, ready for the market. Have you any information on the possibility of a small amount of cyanide being included in the cadmium plate or remaining on the surface, which, of course, would be very harmful if it got into the human system?

A.—We have the following information from the Department of Health of the State of New York regarding the use of cadmium plate on cooking utensils or around food products:

"At present we know of no specific laws in this state pertaining to the use of cadmium plate on cooking utensils or in connection with food products. There are two aspects of the problem which would furnish reasons for this department to discourage the use of cadmium plate on cooking utensils. First, there is the question of the use of cyanide solutions in connection with the plating process. You probably know that the use of cyanides for the cleansing of metal utensils, etc., in hotels and restaurants is already forbidden by the State Sanitary Code. There are possibilities of cyanides remaining in utensils plated by a process which involves the use of this substance.

"Second, certain compounds containing cadmium possess toxic properties. The literature further indicates that fairly small amounts of such compounds are toxic and may be more so than large amounts, probably because large amounts act as an emetic and thus prevent absorption. There are, therefore, possible dangers from the use of cadmium on cooking utensils, particularly since it is definitely soluble in acids, even the weaker organic acids of vegetable origin.

"For the above reasons this department would not recommend the use of cadmium plated cooking utensils."

Ed.

Developments in Low pH Nickel Plating

By W. H. PHILLIPS

General Motors Corporation, Detroit, Mich.

Results of Operating Nickel Baths at Varying pH Values, Temperatures and Current Densities.

FROM THE MONTHLY REVIEW OF THE AMERICAN ELECTROPLATERS' SOCIETY, SEPTEMBER, 1931

SOME time ago I presented a paper on low pH before this Society. Since that time there have been a few further developments, and I would like to bring you all up to date, from a more or less practical standpoint.

We have had considerable experience in running the low pH bath. We have about 60,000 gallons in operation in the General Motors Corporation, and there is probably a like amount outside of the General Motors in the Detroit district. Outside of the district I don't know just really what has been done.

One of the first things that was rather interesting as we went into the development was a series of tasks that we really made to find out what distribution of copper and nickel we should make if we were going to make the deposit .001" thick. So we tried a different series of those tasks.

In the first case, there were nickel only, carrying a thousandth of nickel. Some had a pH of 2.5, others a pH of 5.8, and still others a pH of 2.5.

The low pH samples, for some peculiar reason, turned out the best. We sent those samples down to Florida for thirty days, and then exposed them for 200 days on the roof of the Research Building in Detroit, so they have had quite an exposure.

In the other group, we had a different distribution. Nickel was one-quarter of a thousandth; copper, seventy-five hundredths of a thousandth. And again, the low pH samples, for some unexplained reason, came out best.

In all cases, the chromium was the same; two ten-thousandths. We don't know whether we should conclude or not that the low pH gives better protection, but that is what those samples would indicate.

Now, another thing that may prove interesting was the fact that it was supposed that the low pH produced a harder deposit, so we made some micro-character tests to determine if that was so. We found it was so. Micro-character readings are pretty hard to make, but these were about as important as any bunch we could get. In the first case, we used a temperature of 130° F. all the way through, and we varied the pH, beginning at the top, 6, 5, 4, 3, 2, as follows:

pH	MICRO-CHARACTER READING
6.0	8.3
5.0	8.66
4.0	7.16
3.0	7.98
2.0	8.28

Now, in the case of temperature, we took a pH of 5.

TEMPERATURE (F.)	MICRO-CHARACTER READING
100	6.54
125	6.90
150	7.56
175	9.65

Now you appreciate the increase in those readings indicates increased softness. The scratch is wider. So that the temperature at 5 pH made a tremendous difference in the softness. The high temperature produced the soft nickel. We tried the same thing at 2 pH, with the following results:

TEMPERATURE (F.)	MICRO-CHARACTER READING
100	5.64
125	6.46
150	9.38
175	10.61

Before anybody else tries to flag me, I will say that there is a discrepancy right there, because at 150° in the previous table we got 7.6, and down here we got 9.38. Nevertheless, we simply attribute that to experimental error. And I may say that these are average readings. As we print the paper, we are going to give all the results, and you can make all your own averages, if you want to.

Now, I may say, as I do in the paper, that this question of hardness, from the buffer's standpoint, is usually a question of roughness. It isn't hardness at all. If the plate is smooth, the buffer pronounces it soft. If it is rough, he will pronounce it hard. So that these micro-character tests don't mean that if you get a scratch at 9.7 the buffer is going to come in and pat you on the back for making a nice plate. He may come in and tell you that it is awful hard. If it is rough, it will be hard for him to buff. The point in that is that you have got to be awfully careful, running at these high rates of speed that the low pH and high concentrations make possible, to keep the work smooth. I think bagged anodes are an awfully good thing. They seem to help. Anything that keeps the solution clean seems to be a good thing. Proper filtration is another good point, and of course, as I pointed out in the original paper, at 3 pH or lower the solution is clear.

Now, it became a question, almost immediately after the publication of this paper, whether or not you couldn't get the same results by increasing the concentration of the nickel salts. So we prepared some test runs, using 400 grams per liter of single nickel salts, against some 250 which we had used in our original experiments. We found out we did get quite a spread. Now, here are the original curves at 250 grams per liter. Here is 6 pH, 5, 4, 3, 2 and 1. Now, understand, all the good plates are over on the left side.

In our concentrated bath 5 pH came way over to the left side, that is, 400 grams per liter. But it went way over to the right, meaning that you have got that area to work in, which is greater than 5 pH there is. There is more area on that side. However, you will notice the effect of temperature there. We tried 90; the high concentrated bath doesn't work as well as the low one does at 90. But as you go over to 110, conditions reverse, and keep right on doing that.

Now, if you take 1 pH in the high concentrated bath, you just have almost all the area there is. It takes in most plants. And that gives you a choice there of operating conditions.

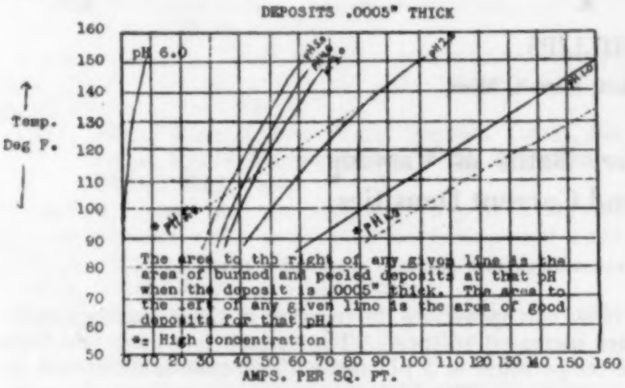


Chart Showing Variation of Quality of Deposit

I may say that these charts were simply proved by the samples.

Now I am just going to say a few words regarding the tactics that might be used in picking out which of those baths you might use for a particular job. There are advantage on both sides. One of the advantages of the high concentration, relatively high pH, is that you don't want to go too high, even with the concentrated bath, if you want to plate rapidly. If you are willing to plate slowly, around 10 amperes or thereabouts per square foot, all right; go on up. If you want to plate rapidly, 5 is about the first place, or 5.5, that you would want to choose, probably. You have more throwing power in that bath than you have in the lower concentration, lower pH bath. So that in certain objects you might want to sacrifice certain of the conditions or certain of the advantages that you would have the other way. You can, however, get a pretty satisfactory throw for most pieces in the 250 gram per liter bath, and as low as 1 pH. The Cadillac Motor Company is plating practically all the pieces they put on the car through a conveyor tank under conditions of that kind. In checking their bath just before I came on, I found it below 1.5 pH. One of the seasons they can do that is that it is a large conveyor tank, where the electrode distances are great, which somewhat overcomes the lack of throwing power. That is also true at the Oakland Motor Car Company, but to a lesser extent. The electrode distances are not so great there, and they have two baths, one of which is run at about 3 pH, and the other in the neighborhood of 1.5.

But just to sum this thing up, on the low pH, you have the clear solution, you have the relatively light dragout. (You see, with 400 grams per liter your dragout is appreciable. I figured that on, for instance, a thousand bumper bars the dragout costs $1.50 per thousand more for the high concentrated bath than it did on the low one. But you might have advantages to offset it.)

Discussion

MR. MCKAY: I would like to ask if these low pH baths are agitated.

MR. PHILLIPS: There is no agitation beyond the fact they are run in conveyor tanks, where the work moves. There is no air agitation or mechanical agitation otherwise.

MR. MCKAY: Do you see any application of this low pH solution to the average job shop?

MR. PHILLIPS: I may say in the city of Detroit that there is one large job shop operating on low pH; another one going to it immediately.

J. H. FEELEY: A job shop, might I ask, that is on production?

MR. PHILLIPS: Yes.

MR. FEELEY: In a small job shop, under normal conditions, do you think high pH is better?

MR. PHILLIPS: No. And I'll tell you why I don't. It is very difficult to get the heavy plates we are demanding now. Speaking for the General Motors Corporation, we are asking for a thousandth of combined copper and nickel. Now, just try and get it with a high pH bath. It is pretty hard to do, unless you have a concentrated bath. It can be done, but it is rather difficult.

MR. FEELEY: In a production shop, time, of course, would be a factor. But in the small shop, where time is not a factor so much, I don't see any objection to getting it with a high concentrated bath and high pH. We are getting it.

MR. PHILLIPS: I have no objection if you have the time, but that is what most people don't have.

MR. MCKAY: How long does it take to deposit a thousandth with this low pH bath?

MR. PHILLIPS: Well, you can, if you want to use the extreme. You can take 130 amperes per square foot. That would go pretty fast.

MR. FEELEY: About twelve minutes.

GEORGE B. HOGABOOM: About eight minutes.

MR. MCKAY: What voltage do you operate at, under those conditions?

MR. PHILLIPS: That, again, would depend on your electrode distance, you see. But I would say that an electrode distance that would plate the ordinary articles at 130° would probably be somewhere around ten or twelve volts. Of course, if you have nice flat objects, you can put up close, then you can cut that way down.

OSCAR SERVIS: Do you have any difficulty with pitting at the various temperatures more or less, and how do you overcome it?

MR. PHILLIPS: Everybody has difficulty with pitting with nickel solutions, even the Bureau of Standards.

MR. SERVIS: I mean, for instance, at 75 degrees Fahrenheit, or 150 degrees Fahrenheit.

MR. PHILLIPS: That is a very fair question, Mr. Servis. There is difficulty with pitting, but there isn't any more difficulty with low pH than there is with high pH, and it is coming and going; it is just unexplained. For instance, we thought when we first started our low pH work commercially, that it accentuated pitting conditions in the beginning. If we added enough peroxide to overcome it then, we thought we wouldn't have so much later on. Well, then, we went, I believe it was to the Frigidaire plant. Mr. Wirshing went down there and started a bath, and he had his peroxide barrel right up close to use, and he never used a drop. The thing started off and didn't pit at all. So that I really don't know personally what makes one solution pit and another one not pit. But I do know from rather extended experience with this low pH that you don't have to add any more peroxide than you do at the high pH.

MR. SIEVERING: I would like to ask whether that is a single salt solution you are speaking of.

MR. PHILLIPS: Yes.

DR. BLUM: High chloride?

MR. PHILLIPS: Reasonably so. We had 30 grams per liter in that high concentrated bath, and 15 in the normal bath.

MR. MCGARVES: What happens when you use about five or six volts with this? Do you get any results at all?

Mr. Phillips: Oh, yes. A great many of them are operated at about five or six volts. It is possible to get up to possibly thirty amperes or more at that voltage, and that is reasonably fast. You know, we are likely to talk about 30 amperes per square foot in a slighting way, but there aren't so many plants over 30 amperes per square foot. Most of them use way under that.

P. C. Strausser: In making up a new nickel solution, you do not purify that solution, that is, remove your iron and zinc and so on? You just use your salt as it comes?

Mr. Phillips: We have used the chemicals just as they came. We suspect that therein lies the difficulty on the pitting, but we don't know.

C. F. Nixon: I was wondering whether or not you had any more light to shed on the use of sodium chloride as opposed to nickel chloride in the low pH bath.

Mr. Phillips: I regret to say I haven't. The question of sodium chloride, or nickel chloride, is one of those things that we haven't had a chance to research on, for the simple reason that the total cost for the Corporation, on what we use, is hardly enough to pay for the research. Now, possibly later on, the Bureau of Standards might take that up and do it for the whole country, and it would be a real item. But with our corporation we just couldn't afford it.

Dr. Blum: I would just like to comment, not especially to ask a question on this thing, but to show the difference in the situation in plating which is illustrated most emphatically by this solution, but which applies as well to other plating solutions.

It is safe to say that the average conception of the electroplater some years ago was that success in plating depended on the formula of the solution that you used. Now, these results, and all that is connected with them, show that it doesn't depend nearly so much on the formula of the solution used as the conditions under which you use it. You can have the best solution in the world and yet poor deposits, and you can have a relatively poor solution and get good deposits, simply meaning that the whole success, particularly on production plating to meet rigid requirements, depends not simply on making up a certain solution, saying that is the formula and we are through now, but on keeping all the conditions, temperature, current density, pH and purity, all maintained in order to get satisfactory results.

The point that I want to emphasize is that plating is a whole lot harder, but probably more interesting than most platers thought ten years ago, because then they were apt to swear by a certain solution and say if they made up a certain formula that that was all that there was to the problem. But I think that we have gone a long way beyond that now.

Metals for Dairy Utensils

By A. EYLES
Manchester, England

What to Use and What to Avoid in the Manufacture of Equipment for Handling Milk Products

GREAT care should be exercised in selecting metals to use in making utensils or equipment for service in the dairy industry. Certain sheet metals in particular should be rigidly debarred. Purity and freedom from poison are essentials. The following are pre-eminently the ones to use: pure aluminum sheet, Monel metal sheet, pure sheet nickel, and highest quality tinned steel sheets and plates.

The superior qualities of pure sheet nickel should not be confused with those of metals frequently sold as nickel but which are merely products of steel with a thin nickel plating that sooner or later wears through, rendering the product unsuitable and unsafe for use as dairy equipment. Pure nickel, Monel metal and aluminum, because of their general physical properties, mechanical properties, resistance to atmospheric conditions, acids, foods, etc., are valuable in the dairy equipment manufacturing field, being superior to zinc, copper or tinned steel sheets.

Aluminum spun and pressed dairy requisites have been known in European countries for many years. Large dairy farms have adopted them after exhaustive tests. Their popularity is increasing more and more, now that the advantages of the metal for dairy utensils and equipment—advantages such as purity, freedom from poison, lightness, cleanliness in use, and ease with which the articles are kept clean—are becoming known and so generally appreciated. Furthermore, in transportation the aluminum cans or transport tanks will keep the milk definitely cooler than steel utensils—another important advantage.

In cheese manufacture, as in brewing, the resistance of aluminum to corrosion is important. The hygienic features of aluminum for dairy equipment have been studied in various European countries, and the judgment of official authorities is overwhelmingly in favor of aluminum in comparison with other metals. Because of its complete neutrality, the quality of the milk and its value for cheese making are absolutely unimpaired; nor is the light metal affected by the fermentation process.

Terne plates, lead-coated sheets, galvanized iron or steel sheets, untinned brass, and untinned copper, zinc and lead are the metals that should be rigidly excluded in the manufacture of dairy utensils, as these materials are capable of entering into solution with certain liquids and juices. Galvanized steel milk cans and pails are sometimes used on dairy farms, but the risk of zinc poisoning and the fear of contamination from the zinc coating are ever present. Splinters from enamelled steel dairy utensils and equipment also have their dangers.

Plating on Aluminum from Cyanide Baths

By HAROLD K. WORK

Chemical Engineer, Aluminum Research Laboratories,
Aluminum Company of America, Buffalo, New York

Deposition Directly on Aluminum and Over a Preliminary Nickel Layer. Electroplating Zinc on Aluminum, Especially with Reference to Corrosion Resistance of Coated Aluminum.

PAPER PRESENTED AT SIXTIETH GENERAL MEETING OF THE ELECTROCHEMICAL SOCIETY, SALT LAKE CITY, UTAH, SEPTEMBER 2–5, 1931.

In an earlier publication[1] the author stated briefly that aluminum could be electroplated on from a cyanide zinc solution and that other metals could then be electroplated over the zinc. Except when zinc alone was the coating metal, however, the corrosion resistance of the electroplate, unless heat-treated, was poor. The purpose of this paper is to discuss in more detail the problems involved in electroplating directly on aluminum from cyanide solutions, to indicate quantitatively the protection of aluminum by zinc electroplates, and to consider the difficulties of applying electroplates on aluminum from cyanide solutions over a preliminary nickel layer.

Direct Electroplates from Cyanide Solutions

After experimenting with electroplating directly on aluminum from numerous cyanide solutions, certain generalizations were derived concerning the best type of solution to use. Such a solution should be characterized by (1) a metal high in the electromotive series, (2) a minimum tendency to attack aluminum, (3) an addition agent, (4) a minimum gas evolution at cathode.

A solution answering these requirements is the following:

	g./L.	oz./gal.
Zinc cyanide, $Zn(CN)_2$	30	4
Sodium cyanide, NaCN	30	4
Ammonium hydroxide, NH_4OH (Sp. G. 0.90)	30	4
Peptone or	1	0.12
Gelatin	5	0.67

Solution used at room temperature.

Of various solutions tested, those having zinc, a metal high in the electromotive series, consistently gave the best results. Other solutions tended to give blistered deposits. Even in plating with zinc it was necessary to modify the usual type of highly alkaline solution. Such solutions attacked the aluminum and only by exercising special care could the electroplates be applied directly. Substitution of ammonium hydroxide for sodium hydroxide reduced this difficulty, but did not completely eliminate it. An addition agent was needed for best results. Of various addition agents tested peptone, gelatin, and gum arabic were most satisfactory. Peptone was most effective, but when a bath was used intermittently gelatin gave more constant results. For continuous plant use peptone has given better service. In using this solution the free cyanide content should be maintained as low as possible, although a small amount is advisable to prevent coating of the anode.

In order to avoid blistering it is better to operate at low current densities, 0.5 amp./sq. dm. (5 amp./sq. ft.) or less. Plates applied from the above solution are quite adherent. As a preparation for such plating the aluminum merely has to be cleaned in a mildly alkaline cleaner of 7.5 g./L. (1 oz./gal.) each of sodium carbonate and trisodium phosphate and given a one-minute dip in 5 per cent HF. This does not specially roughen the surface. Due to the low current density used in plating this particular cyanide solution finds its greatest application merely to form a thin preliminary coat before other more rapid plating solutions. A variety of electroplates have been applied over this thin zinc electroplate and very adherent deposits have been obtained. Unfortunately, however, with the exception of zinc and special heat-treated combinations, these secondary coatings are not particularly resistant to corrosion. The softer metals, as copper, usually blister on exposure to moisture or in the salt spray test, while harder metals, such as nickel, usually peel. On the other hand, where zinc alone is the coating metal this type of corrosion does not take place. In fact, the aluminum is actually protected by the zinc.

The method of zinc plating used for the corrosion experiments reported later consisted in applying a five-minute electroplate of cyanide zinc from the above solution and then plating thirty minutes in the following acid bath[2] at 3 amp./sq. dm. (28 amp./sq. ft.) to give a deposit 0.025 mm. (0.001 in.) thick:

	g./L.	oz./gal.
Zinc sulfate, $ZnSO_4.7H_2O$	360	48
Ammonium chloride, NH_4Cl	30	4
Sodium acetate, $NaC_2H_3O_2.3H_2O$	15	2
Glucose	120	16

While a cyanide bath could be used for the latter coating, this acid bath is somewhat easier to operate. Other acid baths will also give good deposits.

Judging from the relative position of the metal in the electromotive series alone, it would not be expected that zinc would electrochemically protect aluminum from corrosion. Actually this is the case, at least under certain conditions. Potential measurements of metal couples by Edwards and Taylor[3] have indicated that in normal sodium chloride solutions zinc is electronegative (anodic) to aluminum.

Investigations of H. C. Cocks[4] also indicated that zinc would protect aluminum. He applied zinc from an acid solution to a sand-blasted aluminum surface. His electroplates, which were only one-half as thick as those reported on in this paper, resisted a sea salt salt water spray (a few minutes three times a day) for about one year. He considered these results quite satisfactory.

The corrosion tests[5] used in this investigation consisted

[1]Trans. Am. Electrochem. Soc. 53, 361 (1928).

[2]Blum and Hogaboom, Electroplating and Electroforming, p. 324 (1930).
[3]Trans. Am. Electrochem. Soc. 56, 27 (1929).
[4]Journ. Electroplaters' and Depositors' Tech. Soc. 5, 83 (1930).
[5]Supplied by courtesy of Dr. L. J. Weber, Aluminum Company of America.

in measuring the change in physical properties of the plated and unplated aluminum resulting from exposure to a 20 per cent salt spray. With 17ST (Cu 4.0; Mn 0.5; Mg 0.5) corrosion was temporarily prevented by plating with zinc. At the end of four weeks in the 20 per cent salt spray the properties of the zinc-plated specimens showed no loss in physical properties, while with the unplated metal a noticeable loss had occurred. At the end of twelve weeks this loss had increased and a small loss had also appeared for the zinc-plated metal. This would indicate that the zinc had protected the aluminum for fully four weeks, but that after that period dissolved and the protection was lost. Such protection undoubtedly has value for certain applications. For general use, however, a duplex aluminum product developed by E. H. Dix, Jr., of the Aluminum Company of America, has greater value. This is known as "Alclad"[6] 17ST and consists of an aluminum alloy core covered by a surface layer of pure aluminum, which is alloyed and integral with the core. Under similar conditions to those used for testing the corrosion of the zinc-plated 17ST, "Alclad" 17ST has maintained its physical properties for several years. When zinc-plated 2S (commercially pure aluminum) was tested similarly for corrosion resistance the electroplated metal lost in physical properties more rapidly than the unplated metal until the zinc was dissolved. This no doubt indicates that the zinc in protecting the aluminum dissolves more rapidly than aluminum itself and has little value in protecting 2S under the above conditions.

Zinc-plated aluminum has another interesting property in addition to its corrosion resistance. It may be soldered by ordinary procedures, providing the electroplate is at least 0.008 mm. (0.0003 in.) thick and that the electroplating has been properly applied. If the coating is thinner the zinc dissolves in the solder before soldering is completed.

Zinc electroplates on aluminum have been of value commercially in preventing seizing of threaded parts. Such electroplates have also been used on a large scale to modify the electrical contact characteristic of aluminum for a special application.

Cadmium has been considered by several investigators as a possible protection against corrosion. Sutton and Sidery,[7] however, reported that cadmium was not as good as zinc except on a seven per cent copper alloy casting. With commercially pure aluminum they reported an electrolytic attack of the aluminum at breaks in the cadmium plate. Quite recently E. Schmidt[8] stated that cadmium on Duralumin and Lantal shows, in spite of some difficulty of application encountered in plating, a very good protective capacity.

[6]Dix, E. H., Nat. Advisory Comm. for Aeronautics, Tech. Note 259, August, 1927.
[7]J. Inst. Metals, 37, (2), 241-270 (1927).
[8]Zeitschrift fur Flugtechnik und Motorluftschiffahrt, 22 141-7 (1931).

Electroplates Over a Nickel Electroplate

For ordinary service it has been advised that plating on aluminum be accomplished by first applying a preliminary nickel layer to a specially roughened aluminum surface[9] and then continuing the plating with the desired metal.

When cyanide solutions are used for electroplating over a preliminary nickel layer the plating difficulties characterizing the use of cyanide solutions on aluminum are greatly reduced, providing the nickel plate is properly applied. A suitable nickel electroplate should be well anchored and should be at least 0.013 mm. (0.0005 in.) thick. Where the nickel plating has been properly handled, the plating of copper, silver, brass, zinc, or cadmium gives no serious difficulty. Practical experience has shown, however, that in a large group of plated articles a few may have a few tiny areas where the nickel is not securely anchored. If cadmium, zinc, and, to a less extent, silver are the coating metals, the areas usually do not cause trouble. Cyanide copper baths and brass baths to an even greater extent, however, may cause a few small blisters to form in these areas. As a result it is advisable to use an acid copper bath for applying the former metal. With brass, the worst offender, such a procedure is not possible. It is necessary, therefore, to be certain that a particularly good nickel plate has been applied and then exercise special precautions in brass plating. The free cyanide content should be kept as low as possible and the gassing at the cathode and resultant tendency for blistering will be reduced. Thereby a good plate may be obtained.

From the above discussion, it will be seen that the problem of plating over a preliminary nickel layer resembled in many ways the use of cyanide solutions directly on aluminum, but that the seriousness of the difficulties is greatly reduced.

Summary

1. A cyanide zinc bath may be readily used for electroplating directly on aluminum.

2. Zinc electroplates alone as contrasted with plates of other metals over a preliminary zinc coating resist corrosion well and actually protect aluminum for a limited time.

3. Cyanide solutions may readily be used on aluminum after a preliminary nickel electroplate, but with some solutions special precautions are needed.

[9]Trans. Am. Electrochem. Soc. 53, 361 (1928).

Fusible Metal

Q.—What is a formula for a low-fusing metal which melts in hot water but has sufficient strength to stand swaging.

A.—If we understand your problem, you are more interested in malleability and ductility than you are in actual strength. All of the very fusible alloys are inclined to be brittle but some are much more so than others. Perhaps the least brittle is the one known as Lipowitz alloy. This has the following composition: bismuth 50%; cadmium 10%; tin 13⅓%; lead 26⅔%.

Lipowitz alloy melts at 158° F. It has a tensile strength of about 4,600 lbs. per sq. in., with an elongation of 20%, **provided the load is applied slowly.** If the work is done gently and with care, this metal can be bent, hammered and worked on a lathe.

Another alloy which is somewhat stronger but slightly less malleable has the following composition: bismuth 44%; cadmium 9%; tin 23½%; lead 23½%. This metal melts at 167 deg. F., has a tensile strength of about 6,000 lbs., with an elongation of 16%.

The point we wish to emphasize is that all of these metals are extremely brittle when subjected to a sudden shock but that the alloys mentioned above can be worked if the work is done gently and slowly.

In preparing the alloys, it is important to keep them thorough stirred during melting, using a hard wood stick for the purpose. If this is not done the individual metals will separate and the desired alloy will not be obtained

H. M. St. John.

Ball Burnishing Hardware

By F. M. BENWAY
Factory Superintendent

This Process Was Used Before Plating in the Old Days of Saddlery Hardware

THE buffing process described is a development of several years of experimenting in that line on the part of the writer while connected with a saddlery hardware manufacturing company, of Montpelier, Vermont. Having been employed by them first when only ten years of age, I remained with them in various capacities for twenty-eight years, the last fourteen of which I filled the office of superintendent. The business of the company was chiefly the manufacturing of small brass, iron, and steel pieces, their specialty being in the field of harness fittings of the finest quality and finish.

The years spent in this line gave me a fine insight into the kind of work in which they dealt. Of especial interest to me was the sand rolling process in use, and after some little experimenting I developed this process into one of the highest standard. I believe that eventually my company had one of the very best and most efficient sets of equipment for this work that could be seen anywhere and the rolling of brass castings was performed in a way superior to any I have since observed in any of the various plants to which I have had access.

While engaged in the work of developing this sand rolling equipment I evolved the idea of buffing by a somewhat similar rolling process. Two years of persistent experimenting finally brought me the satisfaction of seeing the plant equipped and doing the work in a manner that exceeded even my expectations.

The process calls for the use of special buffing balls upon which the success of the work is dependent. These balls called for the most persistent experimenting before I reached the type and quality desired. They are made in several sizes, according to the size and type of the pieces to be treated. Ordinarily hard and tough, these balls become softer and more pliable when in use, thus providing the means of buffing the pieces with which they are being rolled.

The barrels in which the rolling is done need be of no special design, any sturdy barrel or drum being readily applicable to this work.

The buffing is done, of course, after the sanding is completed. A run of from three to six hours generally suffices to do a first-class job, the exact time required depending on the class of work being handled. The contents of the barrels are then removed and the buffed pieces are ready for plating. If no plating is to be done and the desired finish is to be bright, this buffing process provides the final stage of manufacture and when that is performed they are ready for marketing.

After the buffed pieces are removed from the barrels it is advisable to remove the balls and sift them, thereby roughly classifying them according to size. They are then allowed to stand idle for a brief period to allow them to rest and cool before being put into use again.

The quality of the work includes every advantage to be obtained by hand or machine buffing and in addition it should be noted that the entire outer surface of the pieces being treated is buffed equally to an even finish. This is not obtainable by any other method of buffing known to the writer except by very painstaking and patient attention to minute details.

On the matter of economy much can be said for this plan. The balls, heretofore described, are really the secret of the success of the invention, and are made by a special process. They can be produced at a cost of only a few cents a pound, which offers the user a real saving in itself. Manual labor, too, is reduced to a minimum, a comparatively small force of men being necessary to operate a group of these machines.

Views of Ball Burnishing Installations

How Do You Do It?

Some Interesting Problems in Electroplating and Metal Working, with Answers by Metal Industry Experts

Dry Batteries

Q.—CAN you furnish us with formulas and materials used in the manufacture of dry batteries? We are interested in any new processes that may have come out as well as the materials used in sealing the cells and cases.

A.—We have been unable to locate for you any recent book on dry cell manufacture that seems at all adequate to supply the information desired. Such books as there are on the subject, deal principally with the testing and use of dry batteries or with their home made manufacture on a rather crude scale. Circular No. 79 of the U. S. Bureau of Standards may be of some interest. This can be obtain from the Superintendent of Documents at Washington, D. C.

Dry cell manufacturers have always been rather secretive about the details of their manufacturing processes, although basically they all use the same methods. A carbon electrode and zinc electrode which also acts as the container, a mix consisting of powdered carbon and manganese dioxide wet with solutions of zinc chloride and ammonium chloride packed into the space between the electrodes, a porous liner, usually of paper soaked with starch or flour paste to protect the zinc can from direct contact with the mix, a seal of hard pitch, colored or left in a natural black; these are common to all. Sometimes the mix is packed into a cloth sack which is inserted into the zinc can. The proportions of the materials used in the mix are varied, depending upon whether the cell is desired to have a long life on a light and intermittent load, or is desired to supply a heavy, more or less continuous current for a shorter period of time. The uniformity with which the material is packed in place is also important. Exact instruction covering these details seems not to be available in printed form.

If you have access to a large public library, we would suggest that you go through the files of the Transactions of the American Electro-chemical society, and also through the indices of Chemical Abstracts. These latter give an occasional article on dry cells which have appeared in a number of American and foreign technical journals.

—H. M. St. John.

Bright Annealing Metals

Q.—I read with interest an article in your August issue, 1931, Volume 29, Number 8, written by A. J. Cowan, Metallurgical Eng. Surface Combustion Corp., Toledo, Ohio, describing various experiments on the proper gas for bright anneal of metals.

In this article he mentioned a proper gas that would keep zinc from volatilizing from various brass mixtures so it would retain its brassy color. I would like to find out if the gas to do this would be difficult to make and, if it would be a practical thing to do for regular production.

This is our problem: We take, for instance, a .125 diameter brass wire, 86 copper, 14 zinc, and bright anneal this in strips formed by drawing through a small pipe treated with gas. We can get a nice bright anneal with good surface, but the color when finished will be a copper color instead of the brass color that enters the furnace. This would indicate that the zinc on the surface of the wire had disappeared, leaving the copper color.

A.—In a case of this kind, there is always some question as to whether the surface appearance of the finished product is due to the volatilization of zinc from the surface, or to the formation of oxide on the surface. Very frequently, it is due to the formation of oxide that can be readily removed by pickling. This condition can be avoided by proper annealing.

The volatilization of zinc is a function of temperature as well as atmosphere, and if in fact, the condition described is due to this cause, it would be advisable either to lower the annealing temperature, or to hold a shorter time at that temperature.—R. J. Cowan.

Automatic Preparation for Chromium

Q.—Enclosed you will find a drawing of the cleaning cycle we use in nickel plating before chrome plating. This cleaning cycle is on an automatic conveyor and the location and size of tanks cannot be changed. Previous to entering the electric cleaner the work was run through an auto sand cleaner and then racked.

It has been our idea to do away with the copper cyanide plate in the cleaning cycle and substitute a 5% cyanide solution; and instead of the tank now containing cyanide to place a 10% hydrochloric acid dip. We would like to have your opinion on this change.

We have been having some articles peel when they were chromium plated, and are wondering if this line-up was not at fault, and if a new one might not be substituted which might remedy this condition. Any recommendations which you have to make would be appreciated.

We produce plumbing, water and gas products.

A.—For your class of work, brass castings especially, we certainly would not advise that you discontinue the use of the copper strike. We would, however, suggest that you use for this strike a solution made according to the formula: sodium cyanide 6 ounces, copper cyanide 1 ounce, carbonate soda 2 ounces, water 1 gallon. We would also suggest the use of a cold water spray for 1 minute after the copper strike, and a 10% hydrochloric acid dip in place of the cyanide dip.

If you still have trouble after you have made the suggested changes, send us a sample of the nickel solution for analysis and we will advise you further.

Oliver J. Sizelove.

Wood Etching

Q.—Would you be kind enough to tell me what kind of acid to use for wood etching. The etching will be used for effect only, and need not be deeper than 1/32, 3/32". It will be made on soft woods.

A.—We would suggest that you use a solution made of caustic soda 6 ozs., water 1 gallon for the etching of wood. Either apply the solution to the surface of the wood or else immerse the wood into the solution. If immersed, warming the solution will hasten the operation.

—O. J. S.

"All Is Not Gold That Glitters"

By A. EYLES
Manchester, England

A "New" Alloy Turns Out to Be An Old Friend in New Form

EARLY in August, a new metal "sensation" found its way into the daily press. The following excerpts, given verbatim, are self-explanatory.

NEW YORK TIMES, August 9. Famous as a city of steel, Sheffie'd is now turning its attention to the production of artificial gold. Successful experiments have been made in casting an alloy of aluminum and copper which has the appearance of gold and this alloy is being made to imitate the various karats of gold color.

The new material is stainless and can be washed with alkali solutions, resisting severe tests. A full dinner service in the new alloy has been made, the price being about the same as that for nickel silver.

City officials hope the boom in the new industry will absorb thousands of skilled workers who now are jobless.

THE CHRISTIAN SCIENCE MONITOR, August 11. They have discovered an alloy of aluminum and copper, practically indistinguishable from real gold and there is already brisk demand for such apparent luxuries. Numbers needing work are being employed in this new industry and it is confidently expected there will soon be a "boom" especially in some foreign countries. The alloy which is made to imitate various carats of gold color is stainless and will stand very severe tests in washing and general wear.

The writer, on the request of THE METAL INDUSTRY, investigated and received the following communications from the manufacturers of this "new" alloy:

"We should like to take this opportunity of correcting some of the very misleading statements concerning our aluminum bronze alloy which have appeared in the press both in this country and abroad.

"The alloy which we are producing at these works and from which we manufacture stamped blanks, sheet wire and small castings, all by the way in the partly finished state—we are not manufacturers of finished goods—is not stainless and it is not a new alloy. It has many virtues but stainlessness is not one of them. We ourselves have never claimed it to be any other than corrosion resisting, which as you will no doubt appreciate is a very different thing.

"The alloy was first made for and to the specifications of Messrs. Mellowes and Company, Ltd., for use in connection with the erection of large glass roofs which is their specialty, and it was only made into spoons and forks, etc., as an afterthought—a rather fortunate one judging by the amount of interest aroused by it all over the world.

"It possesses remarkable properties in that it can be made soft enough for spinning into fairly intricate shapes, and yet when cold worked sufficiently, its tensile strength approaches that of mild steel. It is, of course, quite easy to anneal and in fact it can be worked in much the same way as a good quality nickel silver.

"Its color when polished is identical with that of 18 ct. gold, and in ordinary use and with occasional cleaning it keeps its color indefinitely.

"Its resistance to atmospheric corrosion is very great and it has many applications in the engineering world, Messrs. Mellowes being the first firm to realize its advantages in this direction.

"To mention a few of the articles already on the market made either in whole or in part from this alloy they include spirit flasks, spoons and forks, steel table knives with hard soldered handles made in aluminum bronze, waiters, beakers, finger bowls, vases, cigarette cases and many other small metallic goods.

"In price the finished goods are about the same as similar articles in good nickel silver.

"We have received inquiries from all over the world and many of them will, we hope, lead to fresh business, but it should be fully understood that the alloy is not stainless and is not a new alloy as we know that it has been known and used both in this country and abroad for many years.

"We hope this letter will form a suitable basis for an article in the American Metal Industry and we should count it a favor if you would correct some of the statements similar to the ones which we have copied verbatim from American papers quoted above."

Sheffield, England. WILLIAM TURNER AND COMPANY, Richard Turner.

This frank letter clears up the "mystery." Great credit is due to William Turner and Company for their honesty and also for their success in popularizing an old alloy of great merit—aluminum bronze.

Tin Plate on Lead Tube

Q.—I have been active in development of electroplating equipment and methods in Tokyo, Japan, during the past twenty-five years. I understand that you are always ready to give aid to anyone interested in such work, and I am now applying to you for some information regarding a problem with which I am trying to deal.

I want to know if there is a good method of depositing a bright tin plate on the outer and inner surfaces of a thin lead tube, in order to give it the same appearance as a tube made entirely of tin.

I should like full directions for application of such a deposit, if there is any way of getting it. The tubes would be used for toothpaste and pasty medicines.

A.—A bright electrodeposit of tin has thus far never been produced.

It would not be possible to electroplate a thin lead tube with tin and have a bright surface. G. B. H.

THE METAL INDUSTRY

With Which Are Incorporated
The Aluminum World, Copper and Brass, The Brass Founder and Finisher, The Electro-Platers' Review

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Editorial

The Paths of Metallurgists

THE recent meeting of the Institute of Metals Division in Boston (reported on page 419 of this issue) showed clearly the direction in which that Institute has been traveling and the road which was at the same time the path of least resistance, and led to the best fields. In its earliest days, the Institute was composed of practical non-ferrous foundrymen and considered only the problems of the foundry foreman and his melting, molding and core-making assistants.

It was not many years, however, before the technical men had charge of the Institute, partly because they were better fitted to run such an organization, and partly because they were, as a group, much more interested in it. At any rate the fact is that in spite of the sincere efforts of administration after administration, its work has settled into the groove of the technical and scientific, having left, probably for good, the department of activity which has always been described by the word "practical."

At this time, the Division has, it seems, two outstanding groups. One consists of the metallurgists in charge of plant operations; the other, made up of research metallurgists engaged only in the laboratory. The latter group uses the microscope, the spectroscope and lately the X-ray machine, searching in new and uncharted lands to locate new alloys and new applications. While the plant metallurgist may do some research along the lines of new methods and improving plant production, essentially he is the connecting link between the laboratory and the man at the bench and furnace. It is through him that the discoveries of the laboratory are applied practically, in the shop.

This development has been natural and healthy. It is a pity that the practical men in the non-ferrous metal industries have not had the same energy and consciousness of their calling as the men in the electroplating industry who have made the American Electroplaters' Society such a power in its industry. It is noteworthy that even the American Foundrymen's Association is largely in the hands of the technical man, and although the practical man receives every encouragement, he is far from predominant.

Platers' and Chemists' Papers

AN editorial in the September issue of the Monthly Review published by the American Electroplaters' Society, throws a sharp light on a question which has always been important in technical societies but is rarely discussed freely in public. It was noted that with only a few exceptions, the men who read papers at the last meeting of the American Electroplaters' Society in Rochester were technically trained and were not actively engaged in the practical operations of plating and finishing. This, as stated by The Monthly Review, is, of course, a real tribute to the American Electroplaters' Society. Men of technical and scientific training are showing their interest in that Society, not only by reading its publications but by attending its meetings and making contributions of their own.

Praiseworthy as this is, it is important to guard against the danger that such papers may take up an undue share of the time and space allotted to educational meetings. It is hard, we know, to get the practical man to talk about his work. It is even harder to get him to write. But it is none the less important that the American Electroplaters' Society should keep the man in the shop in the front ranks of its meetings. There are many societies which started out as representatives of the practical man, but for a variety of reasons changed in character and are now composed only of technical men or scientists. It is true that the academically trained man has a great advantage on the floor of a meeting, or with a pencil and paper, over the layman. He has been taught to read more rapidly and more widely. He has been taught to speak freely and to put his ideas on paper.

The managers of educational programs (not only of the American Electroplaters' Society, but of any organization which has at heart the welfare of the shop or operating personnel) should, therefore, redouble their efforts to bring out reports and papers from those who represent the shop foreman and superintendent. This problem is particularly important to the American Electroplaters' Society which has in the past maintained an unusually good record in this respect. Our discussion here is not a criticism of its past but rather a word of caution for the future.

Wage Cutting

AFTER months of hesitation, obviously against their will, the U. S. Steel Corporation reduced the wages of the men in their plants by 10%. This action was followed immediately by similar reductions by several other companies. Needless to say the cuts were not greeted with applause by the Federal Government, the newspapers or the public. The best that can be said for them was that they were unfortunately necessary. The questions now being asked are: Will these wage cuts stabilize prices? Will they stop bidding for work at figures below cost? Will they stimulate buying? Only time will answer these questions satisfactorily.

It is of more than small importance that so much resistence is in evidence against wage reductions. Even the

Mining Congress Journal, one of the most conservative of the representatives of industry, for years an unswerving opponent of labor unions, recommends cautiously maintaining the hourly rates of wages but reducing the hours of employment; in other words, keeping the standards of payment as they are.

The only crumb of comfort is the fact that the cost of living has gone down, but whether or not more than wages in general, it is impossible to say. The answer for the individual is never broad statistics but the facts in his own case. It is well known that there is wide variation in all of the factors that enter into living costs, depending upon local conditions. As regards the relative value of labor and its output today in comparison with former years, we have the analysis made by the Merchants' Association, of the Census of Manufactures in New York City.

The average value of products turned out by each wage earner increased between 1927 and 1929 from $10,357 to $10,596. The value of the product per dollar spent in wages rose from $6.32 to $6.55. The average earnings per wage earner declined from $1,637 to $1,617. If New York is a true sample, labor has been producing more while its earnings have decreased slightly.

In the brass industries wage rates have been cut, regretfully, in the past, and while there are no guarantees given or possible to ask for the future, it is stated emphatically that further cuts will be made only as a last resort.

We have heard some harrowing stories of "efficiency" men to have chosen this time to show their worth by cutting wages in all directions to an extent uncalled for and unjustifiable, in order to "make a showing." We believe that these are isolated cases, and not representative of industrial engineers as a whole, whose leaders have always maintained their reputation for probity by being careful of the rights of labor, capital and management alike.

Nothing would be more welcome to employers as well as employees than a turn in the direction of prices which would bring with it the return of wages.

And Now an Aluminum Deluge

IN the early days of the industrial growth of this country when it was discovered that special brasses, bronzes and babbitts had extraordinary properties, there was a period, all too long, when everybody who worked in a metal plant or used a metal bushing had a "new" idea about the world's best alloy. Consequently, there was a flood of special mixtures, each with its own name. No one has ever been able accurately to count the number of different base metal alloys "invented," but certainly it runs up into the thousands. Within the last few years steps have been taken to correct this situation and now we have, for example, a list of standard copper base alloys including 20 compositions, specifications for which have the backing of the American Society of Testing Materials, the Non-Ferrous Ingot Metal Institute and other interested organizations.

We are now faced with a new deluge. Aluminum with its many proved merits and its steadily and rapidly widening fields of usefulness, is calling on the inventor to participate in its growth. We already have a score of standard, well known mixtures. In addition to these we have newcomers, seemingly at the rate of a dozen a month, each with its special title, composition withheld or vaguely described, and all of them surrounded by glowing descriptions of their manifold advantages over anything which exists at this time. For example, a recent statement in the press lists in a short half column, six or seven new alloys developed recently in Europe, which by the way is no small offender in this regard. They bear such striking titles as Vedal, Alugir, Avial, etc.

We know, of course, that new alloys of every metal will be developed from time to time. We know also that these alloys must be designated or named in some fashion to differentiate them in some simple way from the others. But we pale at the thought that we will now have to bear, in aluminum, that we have gone through in the brasses, bronzes and babbitts.

Is there no way out?

A Seal of Zinc Quality

THE zinc industry has taken a step which may well be a guide for the electroplating, and for that matter many other trades. The American Zinc Institute has adopted a seal of quality trade mark which guarantees a zinc coating of not less than 2 ounces of zinc per square foot, thus assuring the consumer that he is purchasing a product of the best available quality. A number of galvanized iron manufacturers have adopted this seal. License to use the seal is available to any manufacturer without charge, but all sheets bearing it must conform with the specifications of the Institute. The Institute will carry on technical work and publicity to aid in the distribution of the product.

Why could not such a plan be adopted by the electroplating industry? It would help to eliminate the unfair competition, rife at this time, by permitting comparison of prices on the basis of quality. It would stop the output of shoddy work masquerading as high grade. It would put all plating on a higher plane.

Faraday Centenary

THERE were held in London during the month of September, the Farady celebrations commemorating the work of the great scientist, Michael Faraday. This is an occasion which might well be observed in the United States, as it was his discoveries of the principle of electrochemical decomposition and his statement of the laws of electrolysis which formed the foundation for the electroplating industry. Faraday's scientific achievements were widespread. They included chemical discoveries connected with chlorine and benzine and they covered alloys of nickel and iron which have in the past two decades assumed considerable importance.

Correspondence and Discussion

Nickel Plating Solution Analysis

To the Editor of THE METAL INDUSTRY:

This is to acknowledge receipt of the Plater's Guidebook and to thank you for the useful information to be found in it.

Enclosed is my method for nickel analysis in plating solutions. I am sending it to you as a return favor, but am also curious to know whether anyone else thinks as well of it as I do. It has been in use in my practice for several years, and I have yet to find anything better. Its accuracy is almost, if not quite, equal to that of more lengthy methods. Conditions of solution as regards concentration, alkalinity, etc., cover a wide range and so permit rapid work. Only one solution is required, the reaction furnishes its own end-point, and there is really nothing to it but a titration.

I appreciate the fact that this procedure is based on a well-known reaction, but consider it a time saver when many determinations are made, and would greatly value your opinion as to its merits.

METHOD FOR ANALYZING NICKEL IN PLATING SOLUTIONS

Take exactly 10 cc of nickel solution in a small beaker and add ammonia in drops until the greenish color has changed to blue, indicating an alkaline condition of solution. Usually some two or three drops are sufficient, though more will not affect the result.

Without diluting or treating the solution in any way further, titrate with potassium cyanide (48 grams per liter) until the precipitate which first forms has re-dissolved. Complete solution of the precipitate is evident within a range of two or three drops, furnishing a satisfactory end-point.

Standardization of Cyanide.—Potassium cyanide of the strength stated has an approximate nickel equivalent of .01 grm. per CC. It is conveniently standardized against crystallized nickel ammonium sulphate. Owing to the unstable character of alkaline cyanides, it is best to facilitate standardizing operations by use of a solution of the nickel salt of definite concentration. Dissolve 6.74 grms. of the salt in one liter water. 1 CC will contain .01 grm. nickel. If desired, confirm by a dimethyl precipitation. However, there is no real necessity for this.

Instead of Potassium Cyanide, we may use sodium cyanide, about 35.5 grms. per liter.

Calculation.—When 10 CC are taken and cyanide has the value 1 CC equals .01 nickel, the result expressed in the usual Oz. gal. way is found thus:

CC KCN times .01 times 378.5 divided by 28.35.

Since all these terms are constant except the first, the last three are expressed by one term, and we have

CC KCN times .1335 equals O/G Nickel.

Discussion.—It is convenient to draw the plating solution from a burette, both for nickel and other determinations, this being more rapid and accurate. For nickel, it is convenient to receive the solution in a small beaker and agitate by means whirling motion.

Neither the exact degree of concentration nor alkalinity of the solution is important.

THE FACTORIES TESTING LABORATORY,
TOLEDO, OHIO. C. R. MCCABE.

The method of determining the metal content of a nickel solution as given may be accurate enough for control work, but the time required with the standard method is so small that we are in favor of the latter. With the method that you give, the end point is certainly not as definite as when potassium iodide and silver nitrate are used.

It is preferable to use pure nickel foil to standardize the cyanide solution, and the calculations may be shortened considerably by multiplying the number of cc of the cyanide used by a factor determined by standardizing the cyanide solution.

OLIVER J. SIZELOVE.

New Books

Psychology of the Inventor. By Joseph Rossman. Published by the Inventors Publishing Company. Size 5½ x 8½, 252 pages. Price, payable in advance, $3.00.

In this book a picture is given of the mental life of the inventor, why and how he invents and how he gets his inspirations. The book contains a description of the actual methods used by inventors, their trials and tribulations, their attitudes and opinions on the material side of inventing, their relation to the promoter and the purchasing public and their experiences before the patent office and in litigation before the courts.

The author is a patent examiner in the U. S. Patent Office, a chemical engineer, a member of the bar of the U. S. Supreme Court and a Ph.D. in Psychology.

A World Survey of the Zinc Industry. By W. R. Ingalls. Published by the Mining and Metallurgical Society of America. Size 6 x 9, 128 pages, paper covered. Price $2.25 to non-members of the Society. (Direct from the publishers).

This survey, under the auspices of the Committee on Foreign and Domestic Mining policy is the first of the major of non-ferrous base metals following the publication of surveys of antimony, chromium, graphite, manganese, mercury, petroleum, platinum metals, quicksilver, tin, tungsten and vanadium, grouped under the title of International Control of Minerals. Coming as it does from the pen of one of America's leading authorities on zinc, it is an important addition to our metallurgical and economic reference literature.

Standards Yearbook 1931. Compiled by the National Bureau of Standards, U. S. Department of Commerce, Washington, D. C. Miscellaneous Publication No. 119. Clothbound, 399 pages, 6x9 inches; price, $1. Obtainable from Superintendent of Documents, Washington, D. C.

This is the complete record of the government's activities in standardization during the past year, covering all phases of the subject. It is invaluable to anyone concerned with standardization.

Journal of the British Institute of Metals. Published by the British Institute of Metals, 36 Victor Street, London, S.W. 1, England. Size 5½ x 8½, 880 pages; price 31s 6d.

This is volume 44 of the series of collections of scientific papers which have been read before this Institute. This is the last to appear in the form that has been familiar to engineers and metallurgists for over twenty years. In the future only papers will appear in the half-yearly volumes, abstracts being published as a separate volume once a year after being issued monthly to members only.

The papers included in this volume were read at the 22nd annual autumn meeting held in Southampton, England, September 9-21, 1930, and published in abstract in THE METAL INDUSTRY for October, 1930, pages 468-470.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice.

Solutions sent for analysis must be PROPERLY PACKED, to prevent leakage and breakage. Chromium solutions should be sealed with glass stoppers. Label all bottles with name and address of sender. Mail all samples to 99 John Street, New York.

Brass Anodes Coat Over

Q.—Could you advise me what to use to avoid having trouble with brass plating as the anodes get corroded? In the morning, until noon, everything is all right; but in the afternoon the anodes get so corroded that I have to dip them in acid.

Is there any chemical to use in the brass plating to avoid this trouble?

A.—A low free cyanide content will cause the anodes to coat over in a brass solution. If any great amount of ammonium chloride is used, the anodes will also coat over.

The addition of a small amount of caustic soda has been found beneficial in preventing the formation of this coating on the anode.

Had you sent us a sample of the solution for analysis, we would have been better able to advise you correctly.

O. J. S., Problem 5,033.

Deadening Sound by Plating

Q.—I would be pleased to have you advise whether or not there is a method of electroplating steel parts in such a manner as to secure a heavy deposit of soft metal for the purpose of reducing noise or metallic ring in parts.

A.—We believe that lead plating of the steel parts would be most likely to reduce the noise or metallic ring of the steel. We would suggest that you use the following formula for the lead solution, and experiment with different thicknesses of deposit for your particular purpose:

Lead carbonate	20 oz.
Hydrofluoric acid (50%)	32 oz.
Boric acid	14 oz.
Glue	0.025 oz.

To prepare the solution, place the hydrofluoric acid in a lead-lined tank, and add the boric acid with constant stirring. When the boric acid is completely dissolved, the solution is allowed to stand until cool, when the lead carbonate is added in the form of a paste with water. The solution is allowed to settle. Then the clear solution is siphoned off and placed in the plating tank. The solution is then diluted to the proper volume with water, and the glue is added by dissolving it in warm water. Mechanical agitation of the solution is essential for smooth deposits.

A cathode current density of 10 to 20 amperes per square foot, and lead anodes are employed. O. J. S., Problem 5,034.

Plating Information

Q.—Please let me know in detail how to hard solder on restaurant and hotel silverware, and what kind of equipment to use; especially, how to solder the parts of individual coffee and tea pots.

What could be the trouble with my generator? It drops the voltage from 8 to 6 after an hour of work. Belt is not loose, the brushes are clean, and everything else seems to be in good condition.

Why does the silver anode get black after the inside plating of a coffee or tea pot?

I have no trouble with my silver solution, but my brother-in-law in San Jose, Calif., has a plating shop, and his silver solution is perfectly clear and can be seen everything in the bottom of the tank, and my solution is a whiskey color. What makes that difference?

Should the work from silver strike come out white, or a little dark? If white, what makes it dark?

A.—In hard soldering the class of work you are doing, it is best to remove the silver deposit by stripping. Use a silver solder with borax as a flux, and the amount of air and gas should be adjusted so that the flame from the soldering torch will not be too large.

If you have had no experience with hard soldering, we would advise you to employ someone who has had experience, as there is quite a knack in doing a perfect job.

We are unable to tell you what causes the voltage drop in the generator. Would suggest that you call in a representative of one of the plating supply houses, and have him look the generator over.

Can see no reason why the silver anodes should turn black, unless the free cyanide content of the silver solution is too low. Old silver solutions have a darker color than new ones, and those that have been in use for some time usually have what is called a "wine" color.

The work should come from the silver strike with a decided dark brown color. If white, either too much silver is in the strike or too low a voltage is used. O. J. S., Problem 5,035.

Plating Calculations

Q.—To deposit a pound of nickel, or a pound of copper, by electrotyping, how much current will this take, or the wattage consumed? You can use other ratios than the pound weight. Also, what thickness per hour, at what current (state your ratio), can be deposited?

My idea is to make miscellaneous articles and ware by electrotyping on models (wax, etc.), molds, etc., which I am going to try to do.

A.—The underlying principle that governs the deposition of metals is known as Faraday's Law, and which states that the quantity of any element or group of elements liberated at either the anode or cathode during electrolysis is proportional to the quantity of electricity that passes through the solution. Also, the quantities of the different elements or group of elements liberated by the same quantity of electricity are proportional to their equivalent weights.

According to this law, a table of the electrochemical equivalent of the different metals has been made and may be found in any text book on electro chemistry.

For instance, it will be found that 100 ampere hours will deposit 3.9 ounces of nickel, also 100 ampere hours will produce a thickness of .0053 inches per square foot.

For further information see "Principles of Electroplating," by Blum & Hogaboom, and also "Electrodeposition of Metals," by Langbein. Both books are for sale by THE METAL INDUSTRY.

O. J. S., Problem 5,036.

Solution Analyses

Q.—We are shipping samples of four plating solutions.

No. 1—This solution plates very slowly. When more current is applied to make it plate faster, the work starts to pit. Work that is supposed to have sufficient amount of plating to buff, in one hour, often takes two or more hours to plate. Only single nickel salts are used.

No. 2—This solution also plates very slowly, in almost the same manner as No. 1.

No. 3—This solution is new, and has not been used very much. However, the nickel deposits very light, and when more current is applied the work starts to burn around the edges.

No. 4—This copper solution does not deposit enough copper to buff. You can rub the copper off with an ordinary brush. The work can be in the solution for a half day, and still you cannot buff the copper up without cutting through it.

Please analyze these solutions and let us know the results as soon as possible.

A.—Analysis of nickel solutions:

No. 1—Metallic nickel		2.20 oz.
	Chlorides	0.98 oz.
	pH	5.8
No. 2—Metallic nickel		2.47 oz.
	Chlorides	0.57 oz.
	pH	6
No. 3—Metallic nickel		3.52 oz.
	Chlorides	1.26 oz.
	pH	5.6

The chloride content of all solutions is too low. The metal content and the pH are satisfactory. Would suggest that you add 1½ oz. of sodium chloride to each gallon of No. 1 solution. To No. 2 solution add 2 oz. sodium chloride to each gallon, and enough hydrogen peroxide to stop pitting. To No. 3 solution add 1½ oz. of sodium chloride to each gallon.

When these corrections have been made, if you still have trouble, look to the current density used. We believe that some of your trouble is due to improper current density.

Analysis of cyanide copper:

Metallic copper	3.68 oz.
Free cyanide	0.48 oz.

We would suggest that you add ½ oz. sodium cyanide to each gallon of solution, and also look to the current density used.

O. J. S., Problem 5,037.

Solution Analyses

Q.—I am sending you six three-ounce bottles of plating solutions for analysis and corrections.

The cyanide copper and acid copper solutions do not seem to deposit a very thick plate, and work does not buff out very good.

A.—Package containing solutions was received in bad condition. The bottles containing the chromium and nickel solutions were broken, so if you will send us another sample of these two solutions, we will analyze them for you.

Analysis of acid copper:

Metallic copper	6.24 oz., or copper sulphate, 25 oz.
Sulfuric acid	2.32 oz.

This is low in acid. Add 1 fluid ounce of sulfuric acid to each gallon of solution.

Cyanide copper:

Metallic copper	2.20 oz.
Free cyanide	0.11 oz.

The free cyanide is too low. Add ½ oz. of sodium cyanide to each gallon of solution.

Cadmium solutions:

No. 1.	Metallic cadmium	3.04 oz.
	Free cyanide	6.89 oz.
No. 2.	Metallic cadmium	3.50 oz.
	Free cyanide	7.20 oz.

Both of these solutions should be operating satisfactorily for still solutions. If they are barrel solutions, add 2 ounces of sodium cyanide to each gallon.

O. J. S., Problem 5,038.

Separating Copper and Lead

Q.—We are melting the lead off copper and lead strips. We are doing this in an iron kettle of 1,000 lbs. capacity. We have tried to control the heat so as not to get the metal too hot, to avoid the mixing of some of the copper with the lead. Our problem is to get the copper out of the lead. Is there not some flux or agent to put into the molten mass so that we can skim off all the copper?

A.—We suggest you use a flux composed of sulphur and soda and lime:

75% sulphur
20% soda
5% lime

When the metal is all melted get a pole of hickory, or a raw potato, and submerge to bottom of kettle and boil the metal. Then cover with flux and let stand for 20 minutes, lowering the heat of the metal by reducing the fire. Then skim. This will remove the copper.—W. J. R., Problem 5,039.

Smelting Battery Plates

Q.—I desire to use a tilting reverberatory furnace for a mixture of lead storage battery fines and nitre cake. Please advise what lining to use. Will regular silica brick lining do or alumina lining?

A.—A furnace of the reverberatory type for lead smelting, whether it be stationary or tilting, should have a magnesite brick-lined bottom, and the same brick should be used in the side walls for at least 6 inches above the slag line. The remainder of the side walls and the roof should be of fire brick containing about 40 per cent alumina. Battery mud or any other substance to be charged into a reverberatory smelting furnace must be comparatively free from moisture to prevent explosions.

The analysis of battery scrap varies considerably, depending upon the condition of the battery at the time of discarding. Analysis of battery mud would vary both with the condition of the battery at the time of discarding and with the method of separating the mud from the coarse particles.

Some idea of the amount and composition of battery mud which is available for separation, whether completely separated or not, might be obtained from the elements entering into a new battery which is estimated as follows:

	NEW BATTERY	SCRAP BATTERY	BATTERY MUD
Antimonial lead	17.80	17.80	3.19
Yellow litharge	6.88	....	....
Red litharge	3.46	....	....
Lead peroxide	....	3.62	3.62
Lead sulphate	.43	5.02	5.02
Sponge lead	....	2.00	2.00
Wood separators	.84	.84	.42
Taps and plugs	.55	.55	....
Asphalt compound	.17	.17	....
Foreign substance	....	1.50	1.50
Dry pounds	30.13	31.50	15.75

The smelting of battery mud is difficult in any type of furnace. The antimonial lead melts easily; also the sponge lead. The peroxide of lead is more difficult to reduce than might be expected. The lead sulphate is almost impossible to reduce in a reverberatory furnace. The foreign substance, dirt, etc., is largely aluminum silicate, entering the slag with lead sulphate, together with such flux as might be used. If no flux were used the slag would be too high in alumina to give good results. To reduce the ratio of alumina to silica, which in this case is in combination, and also to assist the decomposition of lead sulphate, a silicious flux is required of high silica content, preferably over 85 per cent silica. To balance the aluminum silicate slag a basic flux of iron or lime or both is required. Soda or nitre cake can be substituted for iron or lime if there is some good reason for using it. The amount of slag produced should be kept as low as possible, the governing feature being to make a slag that can be easily drawn from the furnace. The lead content of the slag will be high, probably sufficiently high to sell to the custom smelters operating lead blast furnaces.

The recovery of antimonial lead from antimonial lead scrap and sponge lead will be high. The metal recovery as metal, from the peroxide and sulphate will be small. It is quite unlikely that the pig metal recovered from the reverberatory furnace would pay the expense of operating the furnace.—W. J. R., Problem 5,040.

Patents

A Review of Current Patents of Interest

Printed copies of patents can be obtained for 10 cents each from the Commissioner of Patents, Washington, D. C.

1,808,809. June 9, 1931. **Apparatus for Plating.** Dwight T. Ewing, East Lansing, Mich. Filed Oct. 5, 1927. Serial No. 224,046. 1 Claim. (Cl. 204-5.)

In a work holder for plating the inside of a cup-shaped differential gear casing, said casing having a plurality of differential spider notches therein which are required to be left unplated, a cup-shaped support into which said casing is received, a ring adapted to rest upon the rim of the casing, said ring having a plurality of ribs extending therefrom into the notches in the casing, an anode disposed in said casing and shaped so as to follow the internal contour thereof, whereby the anode will be spaced a uniform distance from the inside walls of the casing.

1,809,136 and 1,809,139. June 9, 1931. **Plating Machine Automatic Workshift.** Constantine G. Miller, Chicago, Ill., assignor to The Meaker Company, a Corporation of Illinois.

A work shift for plating machines comprising a plating tank, a trackway along said tank, said trackway comprising insulated end sections and a central bus bar section, means for delivering a work rod to the first insulated section of said trackway, a reciprocating rack for moving the rod onto the bus-bar section during one cycle of movement of the rack and away from said bus-bar in the same direction during the next cycle of movement of the rack.

1,809,621. June 9, 1931. **Inhibitor.** Harry P. Corson, Lakewood, Ohio, assignor by mesne assignments, to The Grasselli Chemical Company, Cleveland, Ohio.

A pickling and cleaning bath for metals comprising a dilute acid containing a small amount of a thiuram sulfide.

1,809,623. June 9, 1931. **Apparatus for Casting Copper Ingots and Other Articles.** Daniel R. Francis, Waterbury, Conn., assignor to The Waterbury Tool Company, Waterbury, Conn.

The combination with a casting wheel for casting metallic ingots, bars, or the like, and having a plurality of casting molds arranged at spaced intervals about said wheel and adapted to be successively brought to a charging position, of means for driving said wheel continuously at varying speeds without the production of shocks or jerks during an operative period consisting of a successive mold charging intervals of relatively slow wheel traveling speeds and mold shifting intervals of relatively higher wheel travelling speeds.

1,809,826. June 16, 1931. **Process of Electrodepositing Chromium.** Walter S. Bohlman, Atlantic City, N. J., assignor to Chromium Corporation of America, New York, N. Y.

A method of electrodepositing chromium comprising projecting a chromic-acid radical plating solution against a surface in the form of a free jet, and passing a current through said jet largely in excess of the current required for normal depositions on an area corresponding to the cross-sectional area of said jet.

1,809,835. June 16, 1931. **Refining Lead.** Philip W. Davis, Cambridge, Mass.

The method of refining scrap storage battery plates which consists in introducing the scrap material into a furnace, heating the material in the furnace whereby the lead alloy and the lead oxides contained in the battery plates are melted in intimate contact with each other in small masses, and flow downward into the bottom of the furnace.

1,809,871. June 16, 1931. **Production of Bismuth.** Walter C. Smith, Moylan, Pa., assignor to Cerro De Pasco Copper Corporation, New York, N. Y.

A process for producing bismuth from a molten bismuth-lead alloy which comprises adding sulfur and a metallic ingredient adapted to unite with the sulphur to form a matte capable of absorbing lead, and separating said matte from the purified bismuth thus produced.

1,809,872. June 16, 1931. **Die for Die Casting and Method of Making the Same.** Victor L. Soderberg, Detroit, Mich.

The method of making a die for die casting which consists in fashioning a die cavity in a block of metal easily cut but unsuitable for exposure as a face for a die cavity, supporting on and insulating from the block a conductor having elements of various sizes, shapes and locations depending on the nature of the portions of the cavities in which they are located, placing the block and anode in an electrolyte suitable for depositing chromium, and connecting the block as a cathode in a plating circuit in which said conductor is the anode.

1,810,409. June 16, 1931. **Method of Plating Metals.** William E. Watkins, New York, N. Y., assignor to Copper Plate Sheet & Tube Company, New York, N. Y.

The method of forming a plating of an alloy of two or more metals on a metal base which comprises passing the metal to be plated through a molten bath of one of the metals of the alloy to form a plating on the metal base, applying a plating mixture of the second metal to the plated metal, heating the coated metal to cause one of the metals of the alloy to diffuse into the other and form a coating of the desired alloy, and then subjecting the coated metal to a temperature sufficient to form a non-stripping plating of the alloy on the metal base.

1,810,438. June 16, 1931. **Metal Fabric and Process for Manufacturing the Same.** Leopold Rado, Halensee, Berlin, Germany.

In the process of producing metal fabric the step which consists in coating metal foil on both sides with a cellulose hydrate, dividing said coated foil into narrow strips and then coating said strips over their faces and edges with a water resisting layer.

1,810,801. June 16, 1931. **Method of Removing Gases from Molten Light-Metals Such As Aluminum and Its Alloys.** Wilhelm Todt, Lautawerk/Lausitz, Germany.

A method of freeing a bath of molten light-metals such as aluminum and aluminum alloys from gases occluded therein, which consists in circulating the gases located above the molten metal, without passing them through the metal and without substantially changing their volume and the temperature of the molten metal, and preventing the admission of fresh air to the furnace.

1,811,142 and 1,811,360. June 23, 1931. **Process for the Recovery of Tin from Alkaline Stannate Solutions.** William T. Little, Westfield, N. J.

In recovering tin in detinning processes with cyclic use of baths, the process which comprises detinning in an alkaline bath containing alkali nitrate and nitrate until a substantial amount of solid alkali stannate is formed, removing such stannate, reacting upon such stannate in solution with nitrous gases to precipitate tin oxid, removing the precipitate and returning the liquor to the detinning bath.

1,811,298. June 23, 1931. **Process and Product for Protecting Aluminum, Magnesium and Their Alloys Against Corrosion.** Charles Boulanger, Clichy, France, assignor to Société Continentale Parker, Clichy, France.

Process for protecting articles made of aluminum, magnesium, or their alloys, against corrosion, comprising the treatment of the said articles in a bath containing carbonate of soda and an alkali salt of the most oxygenated oxide of a metal capable of forming at least two oxides the most oxygenated one being soluble in alkaline solution and the less oxygenated one being insoluble.

1,811,409. June 23, 1931. **Electroplating Apparatus.** Albert F. W. Thormann, Pittsburgh, Pa.

A continuous working apparatus for electrodepositing a copper coating on wire rope or similar products, comprising a tank for the electrolyte, a drum in the tank, rotary rods carried by the drum, rope seizing and guiding grooves in the

rods, the rope being spirally wound around the drum in the grooves and successive grooves in adjacent rods being relatively offset conformably to the spiral path followed by the rope and means for rotating the rods.

1,811,485. June 23, 1931. **Method of Forming Metal Foils.** Gibson Yunblut, Dayton, Ky., and Harry C. Fisher, Cincinnati, Ohio, assignors to The Richardson Company, Lockland, Ohio.

A method of making foil which consists in forming an emulsion of finely divided metal, driving off the emulsifying agent while same is supported on a liquid, and uniting the film into a foil by establishing contact therewith to make of the film a cathode, said film being supported at this stage particularly, on an electrolyte.

1,811,487. June 23, 1931. **Hard Facing Alloy.** Elmer C. Belding, Whittier, Calif., assignor to National Tool and Metals, Incorporated, Torrence, Calif., a Corporation of California.

A hard facing alloy comprising fifty-five per cent tantalum, four per cent molybdenum, forty-one per cent tungsten.

1,811,505. June 23, 1931. **Coating Apparatus.** Joseph A. Kennedy, Pawtucket, R. I., assignor to Anaconda Wire and Cable Company, New York, N. Y.

A lacquering box, comprising a body portion forming a lacquer reservoir, a member adjacent the reservoir and having a tube receiving passage and a connecting port through which lacquer flows from the reservoir to the first said passage, and means whereby the said member can be moved to a position closing said port.

1,811,682. June 23, 1931. **Nonferrous Alloy.** Ralph L. Binney, Toledo, Ohio, assignor to The Binney Castings Company, Toledo, Ohio, a Corporation of Ohio.

An alloy having high resistance to scaling and checking at high temperatures, the ability to withstand distortion, and low coefficient of expansion, the alloy containing from 40 to 80 per cent copper, from 10 to 30 per cent nickel, from 6 to 9 per cent aluminum, from 6 to 9 per cent zinc, and from an effective amount up to 5.0 per cent vanadium.

1,811,696. June 23, 1931. **Carbon-Free Metal.** Paul Dyer Merica, Westfield, N. J., and Augustus Ernest Kayes, Huntington, W. Va., assignors, by mesne assignments, to The International Nickel Company, Inc., New York, N. Y.

The process of producing nickel-containing castings, which comprises melting the metal, subjecting it to a treatment which completely oxidizes any carbon present, boiling out the resultant gaseous oxides, and thereafter adding silicon and magnesium and substantially completely deoxidizing the nickel.

1,812,567. June 30, 1931. **Solder for Aluminum and Its Alloys.** Frederic Strasser, New York, N. Y.

A solder for articles of aluminum and aluminum alloys containing 10 to 30 per cent zinc, 7 to 15 per cent aluminum, 1 to 5 per cent copper and 1 to 8 per cent bismuth and the rest tin.

1,812,909. July 7, 1931. **Apparatus for Burnishing Silver Plate.** Louis Trinquet, Pavillon S/Bois, and René Marcel Hamel, St. Ouen, France.

A machine for mechanically burnishing and polishing objects chiefly covers comprising a rotary tool, oblique working ribs provided thereon, means for yieldingly pressing the tool to bear tangentially through its working ribs against the object to be treated, means for shifting the angular position of the said means with reference to the axis of rotation of the tool and means for making the object advance in a direction perpendicular to the axis of rotation of the tool.

1,812,992. July 7, 1931. **Method of Casting Metals and Alloys Therefor.** Walter C. Smith, Moylan, Pa., assignor to Allied Process Corporation, New York, N. Y.

In the method of making sound casting of "copper" the step which consists in adding lithium to the molten metal at the customary copper refining temperature of from about 1100° C. to about 1250° C. in amount from 0.00018% to 0.04% of the weight of the metal.

1,812,993. **Process of Refining Metals.** Walter C. Smith, Moylan, Pa., assignor to Allied Process Corporation, New York, N. Y.

In the process of producing sound castings of "copper" the steps which consist in first at least partially degasifying and deoxidizing the molten metal by the addition thereto of an agent other than lithium and thereafter adding to the molten metal lithium in quantity of from about 0.0001% to about 0.05% at the customary copper refining temperature of from about 1100° C. to 1250° C.

1,813,324. July 7, 1931. **Lead Alloy.** Robert Jay Shoemaker, Chicago, Ill., assignor to S. & T. Metal Company, Chicago, Ill.

A tough, slightly hardened, non-corrosible lead alloy consisting principally of lead and containing the following substances in quantities by weight substantially as follows: Calcium 0.1% to 0.4% and tin 0.5% to 2.0%.

1,813,842. July 7, 1931. **Process of Producing Protective Metal Coatings.** Colin G. Fink, New York, N. Y., and Charles H. Eldridge, Metuchen, N. J., assignors, by mesne assignments, to United Chromium, Incorporated, New York, N. Y.

A process of producing protective coatings comprising electrodepositing a plate of one of the herein described resistant metals, mechanically treating to heal or eliminate pinholes, and coating with a second coat of metal.

1,813,850. July 7, 1931. **Aluminum Alloy.** Horace Campbell Hall, Littleover, Derby, and Tennyson Fraser Bradbury, Derby, England, assignors to Rolls Royce, Limited, Derby, England.

As a process in making a casting of the following metals, to wit:

	Per cent of the whole
Copper	0.5 to 5.0
Magnesium	0.1 to 1.7
Nickel	0.2 to 1.5
Iron	0.6 to 1.5
Silicon exceed'ng	0.55 to 2.8
Titanium	up to 0.3
Manganese	up to 0.3
Aluminum	the remainder

Only traces of other elements.

Before pouring the molten alloy into the mold, plunging into it a small quantity of metallic sodium not exceeding 0.01 per cent of the alloy to be treated.

1,815,071. July 21, 1931. **Nonferrous Alloy.** William B. Price, Waterbury, Conn., assignor to Scovill Manufacturing Company, Waterbury, Conn.

An alloy comprising essential amounts of copper, aluminum and nickel in proportions substantially within the following ranges:

	Per cent
Copper	80 to 85
Aluminum	1 to 2½
Nickel	1 to 2½

Remainder being mostly zinc.

1,815,081. July 21, 1931. **Chromium Plating.** Erwin Sohn and Ralph J. Paddock, Bellevue, Pa., assignors to Standard Sanitary Mfg. Co., Pittsburgh, Pa.

The process of chromium plating, which comprises passing an electric current through a bath containing from 150 to 450 grams of chromic acid, from 0.35 to 1.05 grams of sulphuric acid and from 0.30 to 3.0 grams per liter of hydrofluosilicic acid to the article to be plated as cathode.

1,815,505. July 21, 1931. **Bright Annealing of Metals.** Robert G. Guthrie and Oscar J. Wozasek, Chicago, Ill., assignors to Peoples Gas By-Products Corporation, Chicago, Ill.

The method of bright annealing metals which consists in heating the metal into an annealing temperature, bringing the metal into contact with an atmosphere of oxidizing gas whereby to remove oily and carbonaceous films from the surface of the metal and produce a superficial film of oxide, and then bringing the metal into contact while so heated with a reducing atmosphere substantially free from unsaturated hydrocarbons whereby to reduce the said oxide film but without the deposit of soot upon the metal.

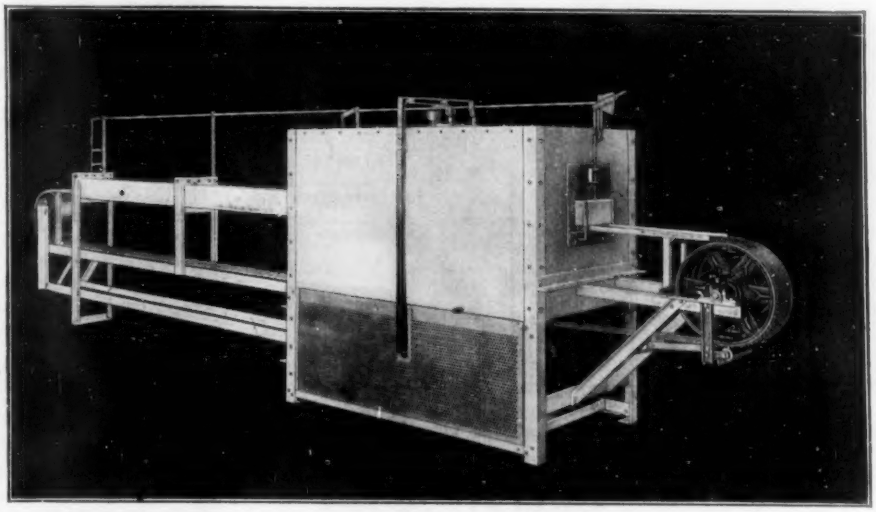
1,815,479. July 21, 1931. **Zinc Base Alloy.** Pascal J. Morell, Waterbury, Conn., assignor to The American Brass Company, Waterbury, Conn.

A zinc base alloy containing about 1 to about 15% copper, and about .005 to about 5% silicon.

Equipment

New and Useful Devices, Metals, Machinery and Supplies

Electric Furnaces for Metal Processing



One Type of Annealing Furnace Produced by Process Engineering and Equipment Corp.

The Process Engineering and Equipment Corp., 5 Falmouth Street, Attleboro, Mass., manufactures a type of electric furnace which, in various arrangements, has wide application in the metal working and processing industries. The furnace is applicable to bright annealing in one operation, without oxidation, pickling, cleaning or drying, according to the maker. The furnace, known as the "Preeco," employs a special atmosphere. This type of furnace is used for bright annealing of such products as strip, blanks, stampings and wire, in such metals as brass, steel, nickel, sterling, copper, nickel silver, phosphor bronze and other ferrous and nonferrous alloys. Vertical and horizontal continuous conveyors are used in designs for particular applications. Another process to which the maker calls attention is copper brazing, which, by means of the "Preeco" furnace, can be carried on without drilling, tapping, riveting or welding, to produce tight joints in a wide variety of metals. Bright silver soldering which requires no cleaning or pickling is another process for which the furnace is recommended by the maker, from whom complete information is available.

New Polishing Composition

A new product containing no free grease, for the purpose of producing lustrous surfaces by buffing, has been placed on the market by The Lea Manufacturing Company, 16 Cherry Avenue, Waterbury, Conn. The new product is known as Learok.

Learok is claimed by the manufacturer to be a new development and a radical departure in clean buffing and coloring, and is stated to have been recognized by the U. S. Patent Office. It is a cylindrical, solid bar containing sufficient lubricating properties to produce a highly colored surface, the maker states. The binder is absorbed by the abrasive and a dry, abrasive-coated wheel with a flexible surface is used.

It is said to eliminate grease caking and packing up and is particularly effective in finishing stainless steel, copper, tin plate, nickel plate, chromium plate, pewter, hard rubber, bakelite and moulded products. It will not freeze, slake, soften or spoil.

New Rotogravure Spot Plater

A new, self-contained spot plating machine for adding and removing copper from the large rolls used in the printing of rotogravure and other intaglio printing processes, developed and manufactured by the Standard Process Corporation, 734-754 Mather Street, Chicago, Ill., greatly reduces production costs on such rolls when erasures or changes on the engraving on these rolls becomes necessary.

The machine, about two feet square and mounted on large casters, contains a motor-generator and the necessary switches and rheostats, electrolyte storage tank, hard rubber pipes and valves for controlling solution pressure in the system, hard rubber pump, and flexible hose and cable. A specially designed hand tool has also been developed which greatly facilitates operation of the outfit. One of the features of the new design is a swinging trough which by means of a set screw may be placed in any convenient position to catch spent electrolyte.

Of very sturdy construction, one of them has been in service for test purposes for about two years without a breakdown of any kind, the maker states. Although designed specifically for use with copper, the manufacturer states that with modifications the machines can be used for other metals as well.

White Gold for Enameling

Sigmund Cohn, 44 Gold Street, New York, offers the jewelry trades a special palladium white gold especially recommended for taking enamel. The maker states the gold is 18K, the alloying agent consisting mainly of palladium with a very small percentage of silver. It is stated that while the color is not quite as good as that of ordinary nickel gold, nevertheless it has been found much more suitable for enameling. Another advantage of the palladium gold is unusual softness and workability, corresponding to platinum in this property. It can be annealed without taking a fire coat, it is stated.

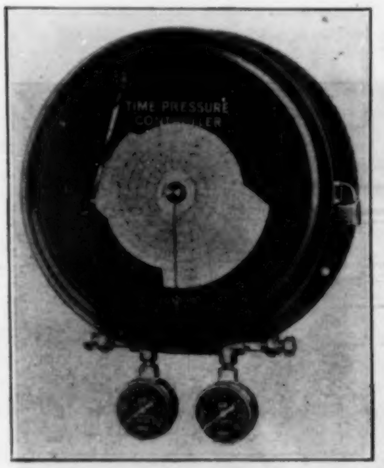
Complete information is available from the Cohn firm at the address above.

New Annealing Process

The Alloy Metal Wire Company, Inc., of Moore, Pa., has developed and patented a special annealing process which, it is said, turns out stainless steel wire, rod and strip with a lustre that needs only a minimum amount of buffing to give it a high polish. The savings thus effected by the delivery of stainless steel requiring but little buffing to impart a permanent lustre, it is claimed, has had its effect with large users of this metal in a substantial reduction of their production costs.

Non-Recording Time Controller

The Foxboro Company, Foxboro, Mass., offers a new instrument for controlling temperature or pressure in relation to time. This instrument, known as the Non-Recording Time Controller, will maintain a predetermined cycle of operation in any process involving temperature or pressure. It is similar in appearance and construction to the standard Foxboro Recorder-Controller. The major difference between the two instruments is that the Non-Recorder has a printed aluminum cam instead of a paper chart,



New Foxboro Non-Recording Controller for Industrial Processes

and a specially designed cam follower in place of the pen arm. This unique construction has made it possible to obtain a 1 to 1 ratio between the cam reading and control point setting, thus maintaining the control point without the use of multiplying devices of any kind.

The cam is a printed aluminum disc the size of a standard Foxboro 10-inch chart. The markings are printed by a special process from plates similar to those used in the printing of Humitex Charts. This feature makes the use of the instrument particularly flexible since new cams to meet changed conditions can easily be cut by the user with a pair of shears and a file.

The controller is designed for use on industrial processes in which the relation of time to temperature or pressure is important. One of the most interesting and successful applications of this instrument is the maintenance of gas pressures in lines where the load requirements are predetermined. In this application, the controller is used in conjunction with a diaphragm motor lever and controlled valve, to build up or let down the pressure in the line according to previously determined load conditions.

Degreasing Metals with Trichlorethylene

Methods of cleaning and degreasing metal articles with the non-inflammable fluid, Trichlorethylene, or its vapors, are discussed in detail in the new booklet, "Trichlorethylene, Its Properties and Uses," just issued by The Roessler & Hasslacher Chemical Co., Inc. "Tri" is described as replacing older degreasing fluids, such as soap and water or high-boiling inflammable solvents, because it is non-inflammable, low boiling, rapid in action, and non-corrosive to metals.

Trichlorethylene is a chlorinated hydrocarbon, water white in appearance, with a sweet odor. It has a boiling point of 86.7°C. (188°F.) and a density of 1.4762 at 15°/4°C., or 1 gallon weighs 12.25 pounds. Its physiological action is lower than that of gasoline, chloroform, and many other solvents, according to available data, and it is non-cumulative in its effect on the human system, according to the maker.

Preparatory to the application of finishing surfaces by electroplaating, painting, shellacking and the like, metal articles are thoroughly and effectively degreased by "Tri" in either liquid or vapor degreasers. In the latter type of equipment, "Tri" is evaporated and its vapors condense on the surface of the work being degreased. The condensed "Tri" dissolves grease and runs off. Degreasing is complete in ½ to 5 minutes, depending on the size of the article, the company states.

Metal furniture, kitchenware, hardware, radio parts, die castings, stampings, nuts, bolts, nails, motor parts, safety razor blades, and many specialties and novelties are degreased by "Tri," it is stated. Large amounts of materials can be degreased in small size installations and with very low loss of "Tri."

Mechanical Chromium Plating Machine

United States patent is pending on an automatic chromium plating device which was invented by Ernest Hinterleitner, 326 Tenth Street, Carlstadt, N. J. In a description of the machine supplied by Mr. Hinterleitner the following statements are made:

The machine will plate automatically all types of small work to which chromium plate is applicable, and will eliminate the necessity of racking or wiring up such work, as is the regular practice in still plating such work. The apparatus is simple, inexpensive and highly reliable, according to the inventor. Units in any suitable size, for small job work as well as for heavy production, can be built without departing from the general principles upon which the machine is designed.

The machine is used in conjunction with a regular chromium plating tank, and is applicable to any tank in which the current density is available. A small machine for plating at one time about 500 pieces each measuring about 1 by 1-3 inches would require about 800 amperes at an average voltage of 5 to 6, which, of course, varies with temperature, type of solution, etc. Thus, shops having chromium tanks and a generator capacity of 1,000 amperes can use the machine effectively and economically, it is stated.

For large installations, specially constructed tanks are supplied. The economies that can be effected in production work with the equipment are said to be very considerable.

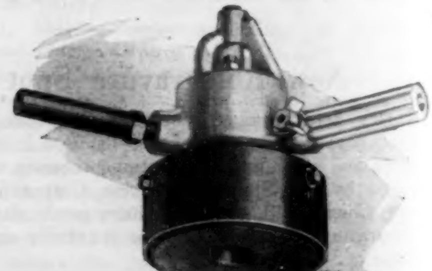
The inventor states that patent arrangements prevent him from supplying more than general details of the development. The invention is based on the principle that automatic (or mechanical) chromium plating is possible only if the work receives sufficient current density for its total surface area. Therefore the connections carrying the current to the cathode must carry sufficient current to the articles being plated, or the weight of the work must be in such proportion to its surface area that there will be a sufficient pressure of the articles on the cathode to assure uninterrupted flow of current. All this has been studied out during five years of theoretical and practical research on the subject, it is stated, and the device is now considered to be the most simple and least expensive and yet most satisfactory from operation viewpoint that is possible. Automatic chromium plating of small work will mean a very great saving in labor. On large installations, loading and dumping will also be automatic, the inventor states.

Further information on this subject may be had from the inventor, at the address given.

New Surface Grinder and Sander

A new grinder and sander of the "multi-vane" type has been added to the Ingersoll-Rand line. This tool, designated as size 4F, is a lightweight, high-production machine which is suitable for grinding, sanding, polishing, and wire brushing operations. It is a powerful, smooth running and correctly balanced tool, the maker

New Ingersoll-Rand Surface Grinder



states. It can be fitted with a grinding wheel, sanding head, or wire brush. Some of the many uses to which it can be put are sanding and polishing automobile bodies, smoothing down welds, cleaning and surfacing large castings for painting, polishing loco-

motive side rods, sanding metal furniture, dies and other metal and wood surfaces, and wire brushing.

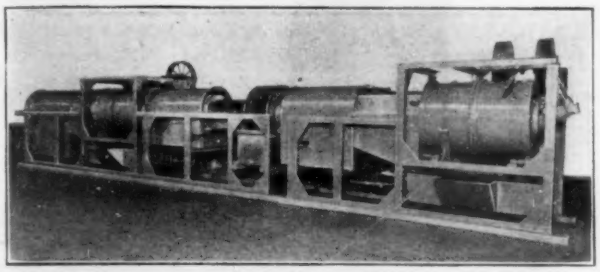
The machine is built with two handles so that the operator can readily hold it at right angles to the working surface. One of the handles may be removed to facilitate working in close quarters. The second handle acts as the air inlet and contains a thumb-controlled throttle valve.

The standard free speed is 4,600 r.p.m., but units can be furnished for higher or lower speeds. Overspeed is prevented by a governor. The size 4F weighs 10¾ pounds without the adjustable guard for grinding wheels. It has an overall length, bare, of 9¼ inches. The manufacturer is the Ingersoll-Rand Company, 11 Broadway, New York City.

Equipment for Cleaning Radio Parts

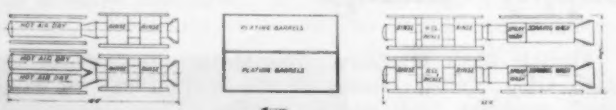
Increased production at considerably lower cost and a general improvement in the quality of the finished product have been secured by the Crosley Radio Corporation, Cincinnati, Ohio, by the installation of new equipment for washing, rinsing and pickling screw machine products and other small metal parts before plating, and for rinsing and drying them after plating, according to N. Ransohoff, Inc., Cincinnati.

The equipment is in two identical units, set up in parallel, operating independently of each other. In both units the operation is the same. Parts are dumped from shop receptacles into a power loading skip which charges the washing machine. The operation of the machine is continuous. In the first drum the work is given a thorough soaking wash. This is followed by a spray wash with cleaning compound, under pressure, for thoroughly removing the dirt loosened by the preliminary or soaking wash. From spray chamber work passes to a rinsing drum, thence to a drum where it is pickled in concentrated hydrochloric acid and then to another rinsing drum. The last three drums dip into the tanks in which they rotate. The last rinsing drum discharges its work directly into plating barrels.



Ransohoff Washing, Rinsing, Pickling, and Second Rinsing Installation at Crosley Plant.

After plating, the work is rinsed through two drums and discharged to a rotary gas-heated drier. This unit consists of a revolving screen with worm, and a hood to prevent radiation. The drier is heated by a "Maxon Premix" gas-air burner. High speed blower directs blast of heated air onto work; worm spreads work out as it travels through drier. One of the parallel lines of equipment is terminated with two drier units instead of one, giving small work a greater opportunity to spread out, and assuring thorough drying.



Twin Production Line at Crosley Plant

A number of related operations are thus performed continuously by a straight line assembly of automatic machines. Almost all labor is eliminated. All worms are welded to remove possibility of small parts sticking to drums. Batches of different kinds of work can be put through the entire series of processes on a 3-minute headway without danger of mixing, it is stated.

This whole line of washing, pickling and drying equipment consists entirely of standard "Ideal" units, installed by N. Ransohoff, Inc., Cincinnati, Ohio.

Lubricated Stoneware Valves

The U. S. Stoneware Company, 50 Church Street, New York City, has placed on the market two new types of lubricated valves applicable to this maker's chemical stoneware valves and faucets. The accompanying diagram shows one type of valve which the maker declares to be a very superior product. This valve is said to have the exclusive feature of elimination of any danger of blowing out bottom of cup because of excessive grease pressure. It is stated that the method of lubricant distribution is highly effective.

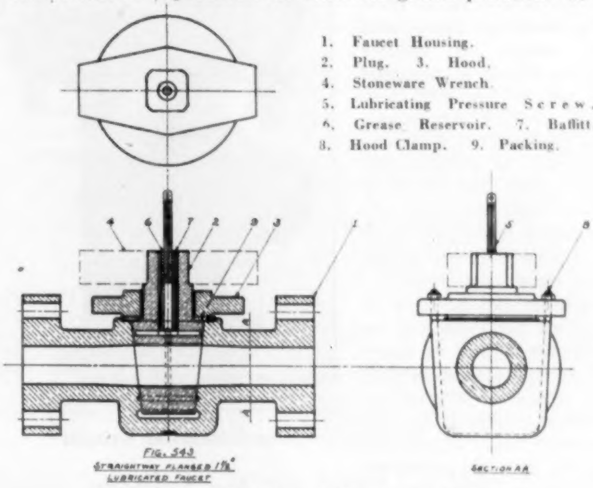


Diagram of Lubricated Stoneware Valve

The company has also perfected a simpler type of lubrication where less expensive equipment is required. Complete diagrams and descriptions of this development are available.

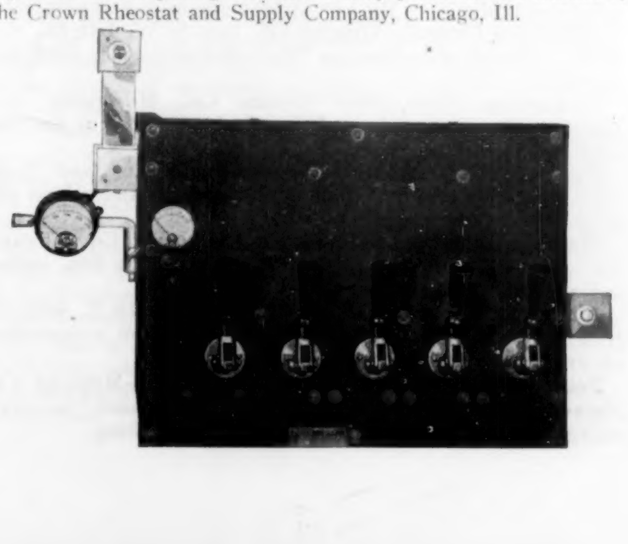
New Chemical Stoneware

The General Ceramics Company, 71 West 35th Street, New York City, has placed on the market Cerawite, a new type of chemical ware. It is described by the manufacturer as a white, china-like stoneware having a white acid-resisting glaze. The glaze is said to have about the same coefficient of expansion as the body, lending it increased durability. The attractive appearance of china but better adaptation to the thermal conditions to which chemical equipment is frequently subjected is said to make this a lightly desirable type of stoneware.

A further advantage is the fact that Cerawite can be produced in large and complex shapes, like vitreous china, for industrial chemical purposes. The maker believes it to be particularly desirable where brown chemical stoneware is in use, but where a cleaner appearance is desired.

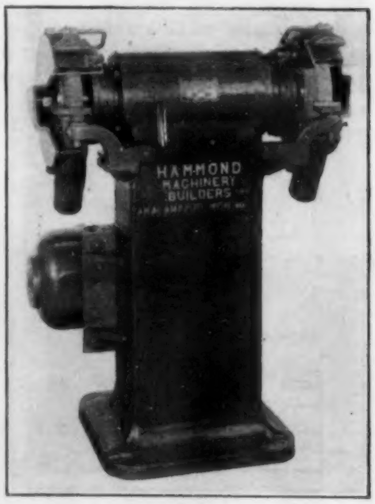
New Plating Tank Rheostat

The illustration below appeared in an item in this section of last issue, where it unfortunately was misprinted upside down. It represents a new plating rheostat recently placed on the market by the Crown Rheostat and Supply Company, Chicago, Ill.



New Multi-V-Belt Grinder

Hammond Machinery Builders, Inc., Kalamazoo, Mich., announce a new grinder, as shown in the illustration. The manufacturer states that this machine differs from the conventional type of electric grinder in that the power is transmitted from the motor to the spindle by means of multi-v belts. Motor is mounted in rear of pedestal. Several distinct advantages are claimed for this construction. It is stated that the spindle housing is of very small diameter, allowing considerable more clearance between grinding wheel and housing; machines can be used at tandem and operated at different speeds, as speed of spindle is not limited to speeds of alternating current motor. It can be supplied with 10, 12, 14 or 16 inch diameter wheels, in one, two, three and five horsepower capacities. An outstanding feature mentioned is that the whole spindle assembly can be removed from the pedestal without disturbing any mechanical part, a particular advantage when necessary to renew belts. Motor is totally enclosed, but ventilated through Hammond patented motor air cleaner.



New Hammond Grinder

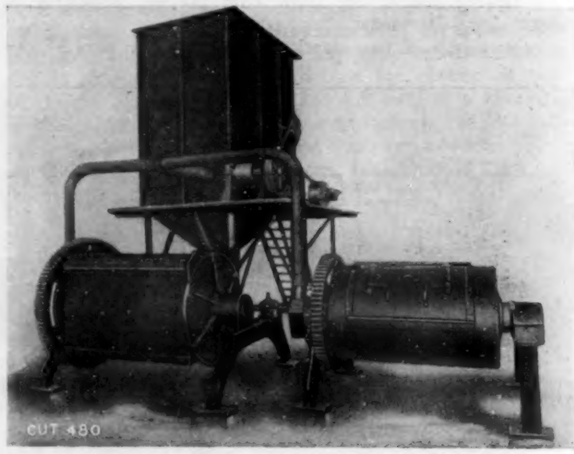
New Aluminum Bronze

The Central Brass and Aluminum Foundry Company, 1020 Woodrow Street, Cincinnati, Ohio, has placed on the market a new type of aluminum bronze containing steel, which is alloyed by a secret process, according to the company. The metal is said to have such highly desirable properties as high tensile strength, hardness, high fatigue, ductility and elongation values, exceptional toughness and a number of other properties. It is corrosion resistant, lighter than ordinary bronze and is suitable for many applications. The metal is produced in a number of grades having varying properties making it suitable for different applications. The company produces castings in this metal, which is known as "Hibbo," and also in ingot form. A pamphlet is available to readers desiring further information, and may be had on application to the company.

New Dust Filter

The W. W. Sly Manufacturing Company, Cleveland, Ohio, has announced a new development in dust filters. This consists of a device which is said to facilitate the complete collection and filtering of dust-laden air in industrial plants. The air, after filtering, passes out completely cleansed of dust. The mode of operation is described by the company as follows:

Sources of dust are connected to the filter and to an exhaust fan by a suitable piping system. The fan may be arranged to draw the dust into the filter or to blow it in. The dusty air enters a large dust chamber where the velocity of the air is reduced and much of the dust drops into hoppers. The remaining float dust is filtered out by means of cloth envelopes to which the dust lightly adheres and from which it is mechanically removed by a cleaning device. Dust may be accumulated in hoppers and periodically removed by hand operated valves, or it may be removed continuously by an automatic valve arrangement. The envelopes are arranged in an ingenious manner which provides a very large filter area in comparatively small space.



A Sly Dust Recovery Installation

The Sly company has issued a bulletin on the new development which will be sent to readers on application to the manufacturer.

Equipment and Supply Catalogs

Arc Welders. General Electric Co., Schenectady, N. Y. Bulletin GEA-1477. Illustrated.

Instruments. The Brown Instrument Co., Philadelphia, Pa. Illustrated bulletin on the new Brown potentiometer pyrometer.

Refractory Cement. Quigley Co., Inc., 56 W. 45th St., New York. Illustrated bulletin on "Pyro-Mortar," a dry refractory cement.

Carburizing. Hevi Duty Electric Co., Milwaukee, Wis. Bulletin 931, illustrated, on "The Carbonal Process for Carburizing Steels."

Rolling Mill Equipment. United Engineering and Foundry Co., Pittsburgh, Pa. Bulletin 101 on rolls and rolling mill machinery. Illustrated.

Welding Equipment. Torchweld Equipment Co., Chicago, Ill. A new vest-pocket catalog of the complete line, including a number of new products.

Air Armaments. Carl Byoir & Associates, 10 E. 40th St., New York. Compilation of statistical data on comparative air armaments of the world. Very exhaustive.

Polishing and Plating. Hanson-Van Winkle-Munning Co., Matawan, N. J. Vol. 2, No. 5 of the "Re-Minder," an interesting house publication devoted to metal finishing.

Flexible Shaft Machines. The McNeil Bros. Co., Cincinnati, Ohio. Initial catalog of the McNeil line of flexible shaft machines, tools and accessories. Illustrated.

Electric Melting Pots. Harold E. Trent Co., 618 North 5th St., Philadelphia, Pa. Bulletin TC-11, on pots, soldering troughs, soldering irons, thermometer calibration tanks, kettles, ovens, etc. Illustrated.

Foundry Progress. The C. O. Bartlett and Snow Company, Cleveland, Ohio. Reprint of a paper "Foundries are Keeping in Step with the Progressive Developments of Industry," by Arnold Lenz, Chevrolet Motor Company, Saginaw, Mich.

Electrical Tools. U. S. Electrical Tool Co., Cincinnati, Ohio. A new catalog of the U. S. line or portable electric equipment for sawing, finishing, drilling, and other purposes. A number of price changes, including reductions, are announced. Apply to Dept. 80, 2462 West 6th St., Cincinnati.

Industrial Advertising. McGraw-Hill Publishing Company, Inc., New York City. A very interesting paper-bound book on how industrial advertising can help reduce the cost of selling. Should make very worthwhile reading for industrial advertisers and others interested in the subject.

Associations and Societies

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

The Electrochemical Society

HEADQUARTERS, COLUMBIA UNIVERSITY, NEW YORK CITY

The Spring Meeting is scheduled for April 21, 22 and 23, 1932, at Baltimore, Md., with headquarters at the Lord Baltimore Hotel. Baltimore is the home of the largest electrolytic copper refinery in the world and it is interesting to note that since the society's last convention at Baltimore, ten years ago, the world's output of electrolytic copper has more than doubled.

The main scientific-technical session will be "The Electric Furnace and Its Products." Dr. J. T. MacKenzie will preside. Manuscripts on any phase of the electric furnace art are welcome and should be mailed to the Secretary before February 15, 1932.

The Society has announced reductions in prices of back volumes of the Transactions. A circular has been issued on this and is available from the secretary.

Society for Testing Materials

HEADQUARTERS, 1315 SPRUCE STREET, PHILADELPHIA, PA.

Committee B-4 of the American Society for Testing Materials through the Chairman, Dean Harvey, Materials Engineer, Westinghouse Electric & Manufacturing Co., has outlined its work for the ensuing year. This committee functions in the field of electrical-heating, electrical-resistance and electric-furnace alloys. A complete circular outlining the work is available from R. E. Hess, assistant secretary.

Committee E-10 on Standards at its meeting on August 6 at Philadelphia approved 13 new tentative specifications and methods of test and the revision of four existing tentative standards. The titles include:

Revisions of existing Tentative Standards submitted by Committee B-5 on Copper and Copper Alloys, Cast and Wrought: Specifications for Copper-Base Alloys in Ingot Form for Sand Castings (B 30-31 T).

Electroplaters and Depositors

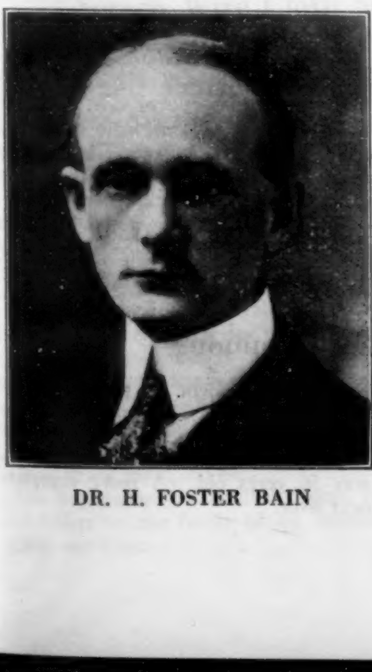
HEADQUARTERS, NORTHAMPTON POLYTECHNIC INSTITUTE, ST. JOHN ST., LONDON, E. C. 1, ENGLAND.

In connection with the Faraday Centenary Celebrations, covering the period Sept. 23-Oct. 3, an exhibition representative of the manifold applications of the work of Michael Faraday was held at Albert Hall, London. An important section of the exhibition was taken up by applications of electrodeposition. Sept. 25 was especially devoted to interests of the Electroplaters' and Depositors' Technical Society. There were several addresses, including "The Rise and Early Development of Electroplating," by Dr. R. S. Hutton, and "Electrodeposition and the Engineer," by D. J. Macnaughton.

Personals

Dr. H. Foster Bain

Dr. H. Foster Bain, mining engineer and geologist, has resigned as secretary of the American Institute of Mining and Metallurgical Engineers, to take up a permanent connection with the Copper and Brass Research Association. Dr. Bain has been doing research work for the Association for the past year, having obtained a leave of absence from the Mining Institute. His resignation takes effect November 1, when he assumes his new connection with the research organization. His resignation from the Institute was accepted only with the utmost regret on the part of the board of directors and all his associates there. He has been secretary of the Institute since 1925.



DR. H. FOSTER BAIN

Dr. Bain was born at Seymour, Ind., November 2, 1871, the son of William Mandeville and Radie (Foster) Bain. He was educated at Moore's Hill (new Evansville) College, graduating with master's as well as bachelor's degrees.

He did two years of graduate work at Johns Hopkins, and took his doctorate at the University of Chicago in 1897. In 1897 he married Miss Mary Wright of Kansas City, Mo., and he has a daughter, Margaret, now Mrs. E. A. Tanner.

Dr. Bain was, during the years from 1898 to 1925, a lecturer in geology at the Universities of Iowa and Chicago; assistant State Geologist of Iowa; a consulting engineer and mine operator; with the U. S. Geological Survey; editor of Mining and Scientific Press; editor of Mining Magazine, London; exploration engineer in South Africa and the far east. During the World War he served for a year as assistant director of the U. S. Bureau of Mines in charge of war materials production. From 1921 to 1925 he was director of the Bureau of Mines. In 1925 he became secretary of the Institute.

Dr. Bain is a director of the American and General Securities Corp.; C. R. B. Educational Foundation; a fellow of the Geological Society of America; member of the British Institute of Mining and Metallurgy, Canadian Mining Institute, A. I. M. E., Institute of Mining and Metallurgy of China, the Japan Society, New York, the Council on Foreign Relations. He is a holder of the Medal of King Albert. His clubs are: Cosmos, Washington, D. C.; Engineers of San Francisco and New York; Miners, New York; University, Urbana, Ill.

Dr. Bain is succeeded as secretary of the Institute by Arthur B. Parsons, who has been assistant secretary since 1929. A complete biographical sketch of Mr. Parsons will appear in the following issue.

R & H Personnel Transfers

The following members of the research staff of The Roessler & Hasslacher Chemical Company, Incorporated, Niagara Falls, N. Y., have been transferred from the plant at Perth Amboy, N. J., to the Niagara Falls, N. Y., plant within the past three months: Dr. Sterling Temple, Dr. B. S. Lacy, Dr. A. M. Muckenfuss, Dr. J. F. Reichert, Dr. C. J. Wernlund, A. T. Hawkinson, A. W. Rudel, J. M. Wainscott, H. A. Bond Other transfers to the Niagara Falls plant include: from Perth Amboy, P. M. Paulson, patent specialist, and M. Marean, librarian; from the New York office, I. L. Ressler, entomologist.

William L. Whitson, president of Matchless Metal Polish Company, Chicago, Ill., accompanied by Mrs. Whitson, has just returned on the Leviathan from a four month automobile tour of France, Italy, Switzerland, Austria, Czechoslovakia, Germany, Belgium and England.

P. B. McBride, head of Louisville Enameled Products Co., Louisville, Ky., plans to acquire a controlling interest in that company, formerly held by Ferro Enamel Corporation. Production will be expanded. Company also operates the Wabash Sanitary Co., producing enameled metal trays, etc.

Frank J. Tone has been chosen as first winner of the Jacob F. Schoellkopf Gold Medal of the Western New York Section, American Chemical Society, for achievement declared to constitute a major advance in science and to embody the spirit of research in industry. Mr. Tone is president of the Carborundum Company, Niagara Falls, N. Y.

Leroy C. Gaines, superintendent, and **Henry M. Stevens,** employment manager, have resigned their positions at Factory H, International Silver Company, Meriden, Conn. They had been with the company for 28 and 15 years, respectively. They are succeeded, respectively, by **Ralph Jahnige** and **Albert M. Mayne.**

A. R. Nichols has been placed in charge of the newly opened Chicago, Ill., sales office of the Waterbury Farrel Foundry and Machine Co., Waterbury, Conn. The office is at the Chicago Daily News Building, 400 West Madison Street, Chicago. Mr. Nichols has had several years sales and engineering experience with the company at Waterbury.

Dr. Emil Eberhardt of Germany, a foremost research chemist, is now occupied in special research work at the laboratories of the U. S. Reduction Company, East Chicago, Ill., aluminum producers. Dr. Eberhardt is working in conjunction with the company's research chemists on new alloys for the aviation industry. The company states it is the doctor's intention to return to Germany upon completion of his work at its plant.

N. H. Whipple has acquired an interest in the Derby Castings Company, brass founders, and will have charge of sales. He was formerly with the Whipple and Choate Company, and its affiliate, the Bridgeport Deoxidized Bronze and Metal Company, for over 18 years. The Derby company is now in a larger plant recently purchased from the Farrel-Birmingham Company, Inc., at Seymour, Conn. The firm has been producing machinery castings, but is now in a position to expand its nonferrous casting production to take in a general line of work.

Albert E. Harrison and **J. M. J. Keogh** were tendered a banquet by the A-C Fifty Year Club recently, in honor of the completion by each of 50 years of service with the Allis-Chalmers Manufacturing Company, Milwaukee, Wis. Mr. Harrison entered the employ of E. P. Allis and Company, forerunner of the present company, on February 28, 1881, and Mr. Keogh on August 8, 1881. Mr. Harrison is general superintendent of foundries and pattern shops, and Mr. Keogh is assistant to the general works manager. Mr. Harrison has the longest service record of any employee of the company. Both men are still active.

Obituaries

F. J. Glennon

F. J. Glennon, vice-president and general sales manager of Aluminum Industries, Inc., died in Cincinnati, Ohio, on September 7, 1931, following an emergency operation for appendicitis. Mr. Glennon who was 34 years old, was the youngest sales manager in the industry and was known widely in the automotive field throughout the country. He had been associated with Aluminum Industries since 1920, when he served as western field representative. He later became western manager, with headquarters at Kansas City, and in 1923 was called into the office as vice-president and general sales manager.

Mr. Glennon was a former director of the National Standard Parts Association, and a member of the Association's merchandising committee. He also was identified prominently with other organizations affiliated with the automobile business. He was a member of The Cincinnati Club, where he made his home, and the Kenwood Country Club. A mother, sister and brother, all residents of New York, survive him.


F. J. GLENNON

Mr. Glennon's death was sudden and came as a distinct shock to the industry. He was stricken during the night of September 4 and rushed to a hospital where an operation was performed on the following morning. Although conscious most of the time, he sank steadily until his death.

Aaron Austin Benedict

Aaron Austin Benedict, 82 years of Waterbury, grandson and last male descendant of Deacon Aaron Benedict who founded Benedict and Burnham Manufacturing Company, died at his home there September 8, 1931. He, his father, George, and his uncle Charles, continued the business founded by Deacon Aaron Benedict. He entered the firm of Benedict and Burnham in 1871 as a bookkeeper, later becoming paymaster and secretary of the company. He continued with it until shortly after the firm was acquired by the American Brass Company, when he retired. He was extremely interested in church affairs. He is survived by his wife, the former Mabel O. Camp; one daughter, Mrs. Dorothy Campbell, and a granddaughter, Marjorie Campbell of Waterbury. W. R. B.

Oscar Smith Foster

One of the most prominent manufacturers of Utica, N. Y., Oscar Smith Foster, president of the Foster Brothers Manufacturing Company, died in Santa Barbara, Calif., and was buried in Utica last month. He was one of the first stockholders and directors of the Savage Arms Corporation. His own company was nationally famous for making spring and metal beds.—E. K. B.

Col. E. A. Simmons

Colonel Edward Alfred Simmons, president of the Simmons-Boardman Publishing Company, New York, publishers of The Railway Age and six other transportation trade papers, died October 1, 1931, at his home in Brooklyn, N. Y. He had suffered a cerebral hemorrhage. He was 56 years old. A more complete obituary will appear in our next issue.

Ernest Edwin Bross

Ernest Edwin Bross, Detroit, Mich., jewelry manufacturer, president of the Traub Manufacturing Company of that city, died September 1, 1931, at St. Petersburg, Fla. Mr. Bross was 52 years old. He originated the orange blossom design for wedding rings when he was a young man and lived to see it come into almost universal use. It took years to popularize it in the face of the favor shown heretofore to the plain gold band. As a young man he went to Detroit and joined Traub Bros. & Co., jewelry manufacturers. This company was succeeded by the firm of which Mr. Bross was president at the time of his death.

J. Wellington Osborn

J. Wellington Osborn, retired jewelry manufacturer of Newark, N. J., died September 9, 1931, at his home in Newark. Mr. Osborn was 81 years old and retired from the firm of Moore & Son, jewelry manufacturers, four years ago. He was at one time affiliated with the late Seth Boyden, widely known Newark inventor. Mr. Osborn is survived by his widow and two daughters.

Samuel J. Wells

Samuel J. Wells, president of A. H. Wells Company, Waterbury, Conn., died suddenly at his home there on August 27, 1931. He was 65 years old, born at Waterbury. His company manufactures brass tubing and other brass goods. He is survived by his two sons, two daughters, three brothers and his mother.

Julius Lewinsky

Julius Lewinsky, president of the Lewinsky Iron and Metal Company, Milwaukee, Wis., died on August 17, 1931, at his home at Elkhart Lake, Wis. He was 64 years old. Born in Germany, he came to Milwaukee 45 years ago.

George M. Porter

George M. Porter, head of George M. Porter Company, metal manufacturers, Boston, Mass., died at his Brookline, Mass., home in latter part of August.

J. A. Merrick

J. A. Merrick, proprietor of a brass and aluminum foundry at Grand Avenue, Galesburg, Ill., died recently. He was also an expert musician.

Charles H. Leinert

Charles H. Leinert, president of Leinert Valve Company, Chicago, Ill., died recently. Mr. Leinert founded his company about seven years ago.

News of the Industry

Industrial and Financial Events

Rome Plants in Safety Campaign

Five industries at Rome, N. Y., have joined in a safety campaign. The companies are General Cable Corporation, Rome Company, Inc., Rome Strip Steel Company, Inc., Edward Comstock Company, Inc., and the Revere Copper & Brass Company, Inc. These are enrolled in the seventh annual state-wide accident prevention campaign of the Associated Industries of New York State, Inc.

Screen Wire Cloth Simplification

Bureau of Standards, Washington, D. C., announces that the Division of Simplified Practice has received sufficient signed acceptances from manufacturers and others affected, to place in effect Simplified Practice Recommendation R122-31, as of October 15, 1931. The Bureau will distribute copies of the printed recommendation as soon as printed.

Brass Ingot Statistics

Non-Ferrous Ingot Metal Institute reports the average prices per pound received by its membership on commercial grades of six principal mixtures of ingot brass during the twenty-eight day period ending September 11, as follows:

Commercial 80-10-10 (1% impurities), 8.502c; commercial 78% metal, 6.922c; commercial 81% metal, 7.181c; commercial 83% metal, 7.396c; commercial 85-5-5-5, 7.645c; commercial No. 1 yellow brass ingot, 6.149c.

On September 1st, unfilled orders for brass and bronze ingots and billets on the books of the members amounted to a total of 21,202 net tons.

The combined deliveries of brass and bronze ingots and billets by the members for the month of August amounted to a total of 3,186 tons.

Aluminum Company Reduces Salaries

Aluminum Company of America, Pittsburgh, Pa., put in effect on Oct. 1 a 10% reduction in salaries throughout its organization. The cut affects about 4,250 employees at the Logan's Ferry and New Kensington plants, the executive offices at Pittsburgh, and other branches and subsidiaries of the company, according to a New York "Times" despatch.

New Companies

Bay State Smelting Corporation has been organized at Boston, Mass., by **Louis Sovrensky;** to produce remelted zinc.

Fuel Economizing Corp., Harrisburg, Pa., has been formed by **C. J. Dunkle, D. E. Shenk** and associates. Will manufacture blowers, heating and temperature control devices, etc.

Chromed Screw Corp., Detroit, Mich.; $10,000 capital; to operate plant for manufacture of chromium plated nuts, screws, bolts, etc., by **Henry A. Strouse,** 5120 Baldwin Ave., Detroit, **W. B. Knight,** and associates.

Non-Ferrous Alloys Company, 6425 Charlevoix Street, Detroit, Mich.; to take over company of that name; $10,000 capital; brass, bronze and aluminum foundry, machine shop, etc.; by **Ralph R. Harwood** and **Edward J. Thome.**

Granville Pollitt of Horwich, England, plans the establishment of a new brass foundry at St. John's, Newfoundland. Mr. Pollitt was reported to have sailed recently from Liverpool, England, with the complete foundry equipment, including 80 tons of metal, to start the plant, which he is to open for a Lancashire firm of brass founders.

Michigan Chemicals, Incorporated, Grand Rapids, Mich., is a new $50,000 corporation, completely equipped with factory and experimental laboratories for the manufacture and development of chemicals and chemical compounds for the metal finishing and chemical consuming trades, and specializing in the manufacture of tripolis, limes, lubricants, steel and chromium rouges, chemicals and chemical compounds, which are used in metal finishing by the plumbing, automobile, refrigerator, builders' and furniture hardware and electrotyping industries. In addition to manufacturing its own specialties, Michigan Chemicals, Incorporated, has been named Michigan distributor for Grasselli Chemical Company, Roessler and Hasslacher Chemical Company and Harshaw Chemical Company. Officers of Michigan Chemicals, Incorporated, are: **J. C. Miller,** president and treasurer; **V. J. Twyning,** vice-president, and **B. L. Miller,** secretary.

Corporation Reports

New Jersey Zinc Co. declared its regular quarterly dividend of 50 cents, payable Nov. 10.

McCord Radiator & Mfg. Co. omitted its 75-cent quarterly Class A dividend, due last month.

Bohn Aluminum & Brass Company declared the regular quarterly dividend of 37½ cents per share.

Chase Brass & Copper Company declared a regular quarterly dividend of $1.50 a share on series "A" preferred.

Scovill Manufacturing Company has declared the regular quarterly dividend of 50 cents, payable October 1st to stock of record September 15th.

Club Aluminum Utensil Company—Year ended June 30: Net loss, after all charges, $260,048, against a net loss of $459,520 in the preceding fiscal year.

Torrington Company and subsidiaries report net profit for the year ended June 30, 1931, at $1,740,343 after charges and Federal taxes, equal to $3.11 a share on 560,000 no par shares, comparing with $2,404,242, or $4.29 a share, in the preceding fiscal year.

Reynolds Metals Company—J. R. Reynolds, president, stated that earnings during past three months had been equal to 55½ cents a share on the common stock. Net earnings for the first eight months of the year, he said, were slightly in excess of those of 1930.

Doehler Die Casting Company have declared the regular quarterly dividend of 87½ cents a share on the 7 per cent cumulative preferred stock, $50 par, and the regular quarterly dividend of $1.75 a share on the $7 cumulative preference stock, no par, both payable Oct. 1st to stockholders of record Sept. 21st.

Anaconda Copper Mining Company issued following statement: "Because of continued lack of demand for the metals and metal products of the company and the extremely low prices prevailing, directors decided to omit action on the dividend at this time. The company's mines are operating at about 40 per cent normal capacity. Compensation of all salaried officers and employes except those in the minimum classes were reduced from 5 to 15 per cent as of July 1st and wage adjustments have also been made." Previous quarterly dividend was 37½ cents per share.

Metal Developments

ALUMINUM was used almost entirely in two new city service buses recently put in use by the Yellow Truck and Coach Manufacturing Co.

BARIUM AND NICKEL are used in composition of a new spark plug point alloy developed at the University of Michigan Department of Engineering Research.

COPPER-IMPREGNATED PAPER has been developed by the U. S. Department of Agriculture for wrapping fruit to prevent spread of gray mold, etc., in storage.

DEFECTS IN METALS are being detected by the use of the gamma ray of radium as a regular procedure by the Bureau of Construction and Repair of the U. S. Navy.

COPPER lightning rods are recommended for protection of high factory stacks and chimneys by the American Mutual Alliance, 2200 Lake Michigan Building, Chicago, Ill., which has issued a circular on the subject.

METALLIZING ferrous products with tin is the business of a British company formed a few years ago and which now has captured some international markets with its products, says a report from Doremus & Co., New York City.

ALUMINUM MESH screen made by Whiting & Davis Co., Plainville, Mass., was installed last month at the "Metropolitan", Boston, Mass., largest Publix-Paramount theatre in New England. Plainville firm makes mesh bags generally.

COPPER PAINT used to paint the bottoms and walls has been found very effective in preventing the growth of algae (microscopic vegetation which grows in a slimy substance). The paint is also said to have a purifying effect on the water.

OVER 3,000,000 LBS. OF COPPER is used annually for construction of "weather manufacturing" apparatus, according to Copper and Brass Research Association. Air conditioning is expected to become a tremendous consumer of copper within a few years.

ALUMINUM ALLOY "Aldrey" is gaining in use for electrical transmission in Germany. "Aldrey" contains no copper or zinc, but has 0.25 to 0.3% iron, 0.4 to 0.7% silicon, 0.3 to 0.5 magnesium. Is said to have greater fatigue and corrosion resistance than other conductors.

ALUMINUM BUS BARS for carrying 220 Kv. are being installed at the Roseland switching station of the Public Service Electric and Gas Co., where there is an interconnection between that company's lines and those of Pennsylvania Power and Light Co., and Philadelphia Electric Co.

MAGNESIUM—A group of San Francisco pilots and designers are preparing two "mystery ships" to be entered in the airplane races at Cleveland. Magnesium alloy has been used for engine construction as well as for propellers, and the gain in horsepower per pound of engine is said to be very marked.

FOUR CARLOADS OF NICKEL in the form of alloys went into the new Waldorf-Astoria Hotel in New York, which opens October 1. The 142,500 pounds represents the biggest single installation of nickel in building construction in the United States this year; 150,000 pounds of nickel silver went into the plumbing; 175,000 pounds of Monel metal was used.

COPPER will be used as an alloy in 30 to 35 per cent of all the steel produced in Germany within a few years, according to a report in "Metal and Mineral Markets," New York. Based on normal steel output, and assuming only 0.25 per cent copper content in the steel thus alloyed, it is figured that Germany alone would require 35,000 tons of copper annually for the purpose.

Business Reports of The Metal Industry Correspondents

New England States

Waterbury, Connecticut

OCTOBER 1, 1931.

William H. Bassett, metallurgical engineer of the American Brass Company, has been appointed honorary secretary of the Massachusetts Institute of Technology, to represent the institute in this district. Mr. Bassett is director and past president of the American Institute of Mining and Metallurgical Engineers; a member and former director of the Institute of Chemical Engineers; a fellow of the American Association for the Advancement of Science. He is on the metallurgical advisory boards of the U. S. Bureau of Standards and the

U. S. Army Ordnance Association, besides belonging to numerous American and British engineering, chemical and metallurgical societies.

The Andrew C. Campbell Company plant, which for the past several years, has belonged to the **American Chain Co.** of Bridgeport, has been closed, and the entire machinery is being moved to Bridgeport. Normally several hundred employes have found work at the plant, but for the last few months not over 50 have been there. The present employes have been assured of jobs in Bridgeport. The firm was chartered in 1912 with a capital of $950,000. Andrew C. Campbell, the president, had designed and patented some of the most successful machines for manufacture of cotter and split pins for automobile construction.

Nyle R. Munson, an employe of the **Chase Metal Works,** has secured a patent on an apparatus for extruding seamless brass and copper tubes. He has had a model of the machine constructed at the Rowbottom Machine Co., and has operated it successfully on a small scale, it is said.

Ferdinand Strauss, Inc., bankrupt local firm, has started a $100,000 breach of contract suit against the **Waterbury Button Co.** in the Supreme Court of New York. The plaintiff claims that in 1930 it contracted with the button company for 250 gross of toy tractors; that the first of the tractors were delivered to the American News Co., and that the latter company notified the Strauss company that the tractors were useless. Similar complaints were received from other companies, it is claimed.

American Brass Co., and **Scovill Mfg. Co.,** it is reported, have received many orders lately for parts to be used in oil burners for furnaces, a business which is said to be expanding rapidly in this state.

Chase Brass & Copper Co., subsidiary of the Chase Companies, Inc., has declared regular quarterly dividend of $1.50 on Series A preferred stock, payable Sept. 30 to stock of record Sept. 21.

John H. Goss, vice-president of **Scovill Mfg. Co.,** has been renominated for vice-president of the Connecticut Manufacturers Association.

Chase Companies, Waterbury Clock Co., Mattatuck Mfg. Co., and **Patent Button Co.,** have abandoned the day-wage plan for most employes, and have adopted the so-called incentive system, which calls for paying for the production shown.

Among patents granted to local applicants during the last month are the following: slide buckle to **C. A. Mosgrove,** assignor to the **Autoyre Company;** resilient button loop to **P. E. Fenton,** assignor to **Scovill Mfg. Co.** W. R. B.

Connecticut Notes

OCTOBER 1, 1931.

HARTFORD—Underwood Elliott Fisher Co. reopened its local factory Sept. 14, after nearly a month's shutdown. The opening was a surprise as it was not expected until Oct. 5. Nearly 2,700 workers were called back. It is not expected to operate on full time schedule for the present.

Colt's Patent Fire Arms Co. declared the regular quarterly dividend of 37 cents a share payable Sept. 30 to stock of record Sept. 17.

Arrow-Hart & Hegeman Co. declared regularly quarterly dividend of $1.62½ cents a share on preferred stock payable Oct. 1 to stock of record Sept. 24, and regular quarterly of 50 cents on common, payable same date.

BRIDGEPORT—The duPont Co. will furnish capital for the **Remington Arms Co.** of this city to acquire the **Winchester Arms Co.** of New Haven. The latter company is now in receivership. The duPont Co. will have but a minority interest in the combined concern. The amount of capital involved in the combination has been estimated all the way from $30,000,000 to $60,000,000. Remington has factories at Ilion, N. Y., and Brimsdown, England; and owns the Remington Arms Co. of New Jersey; the Remington Cash Register Co. of New York; the Remington Arms Co. of England; the Remington Cutlery Works of this city; and the Consolidated Automatic Merchandising Corp. It manufactures firearms, ammunition, cutlery, vending machines and cash registers. Winchester controls Barney & Berry, Inc., Boston, makers of skates; the Whirldry Corp., New Haven; and the Walden Knife Co., Walden, N. Y. It manufactures ammunition, shot guns, rifles, tools, cutlery, skates, fishing tackle, sporting goods, electric washing machines, flashlights, batteries and radiators for automobiles and airplanes.

A. B. Ely, formerly chief engineer of the **Bassick Co.,** has been appointed production manager of **M. H. Rhodes,** manufacturers of electric switches.

C. P. Peterson, Naugatuck, has been granted a patent on a waste fitting for sinks, which he has assigned to **Bridgeport Brass Co.**

BRISTOL—Bristol Brass Corp., after paying for the 2,400 shares of preferred stock it recently called in, will have more cash on hand than it had Dec. 31, 1929. The amount required for the stock was $265,000, and the amount of cash on hand at the end of 1929 was $216,000.

E. Ingraham Co. has increased its working hours to 50 and 55 a week. For several months it operated on a 32-hour week schedule. No additional help is being hired, although the company is taking back some employes formerly laid off. About 1,200 are employed now.

New Departure Mfg. Co. has closed down from Sept. 24 until Oct. 5. It employs about 4,000 persons here.

Veeder-Root Co. plant has increased hours from 35 and 40 to 45 a week. A slight seasonal increase in business is reported by **President J. Ernest Andrew** of the **Wallace Barnes Company.**

Edward Ingraham, president of **E. Ingraham Co.,** has been nominated a director of the Connecticut Manufacturers' Association.

NEW BRITAIN—American Hardware Corp. directors have voted the regular quarterly dividend of $1 a share on common stock, to be paid Oct. 1.

Stanley Works directors have voted the following regular quarterly dividends: preferred stock, 1½ per cent, payable Nov. 16 to stock of record Nov. 7; common stock, 2 per cent payable Oct. 1 to stock of record Sept. 17.

Landers, Frary & Clark directors have declared the regular dividend of $1 a share on common stock, payable Sept. 30. At the meeting last month they elected **Daniel M. Shepard,** formerly a sales manager, as a vice-president, to succeed **H. M. Parsons,** recently resigned.

TORRINGTON—At the annual meeting of **Torrington Co.** stockholders last month, the following officers were elected: president, **W. R. Reid;** vice-president, **C. E. Roraback;** treasurer, **A. W. Burg;** secretary, **Lester J. Ross.** A regular dividend of 75 cents a share on the common stock was declared payable Oct. 1. Reports showed the company and its subsidiaries had net profits of $1,740,434 for the year, equal to $3.11 a share, compared with $2,404,242 or $4.29 a share for the previous year.

A patent on an anti-rattling device for automobiles has been granted to **P. J. Fitzgerald,** who has assigned it to the **Fitzgerald Mfg. Co.**

WINSTED—The plant of the **Winsted Insulated Wire Co.,** recently sold at auction after the company went into receivers' hands, will be reopened for manufacture of enameled wire, it is announced by **Otto Bitzer,** former general superintendent of the **Acme Wire Co.,** New Haven. He represents **Charles F. Royle,** secretary of the **Hudson Wire Co.,** who recently bought the plant. It is planned to manufacture the wire, dip it in enamel, and bake it.

William L. Gilbert Clock Co. has announced a contemplated cut in wages amounting to 10 per cent. It has been running on short time for several weeks, but recently received a large order from Seattle, which is expected to keep the plant busy for two months. Some of the employes previously laid off have been recalled.

THOMASTON—Earl De Bisschop, superintendent of the Marine shop; **Forbes Gibbs,** superintendent of the main plant; **Albert Mellor,** superintendent of the tower plant, and **Foreman John Johnston,** all of the **Seth Thomas Clock Co.,** had a narrow escape from drowning last month when the boat in which they were fishing in Long Island Sound capsized.

NORWALK—Gilbert & Bennett Co. has added to its line

of products two varieties of fly wire cloth. The working force has been increased somewhat.

TERRYVILLE—Eagle Lock Co., employing more than 2,000 persons, has announced a 22 per cent reduction in wages on the piece-work basis, and a 20 per cent cut in wages on the hourly basis. It has also cancelled all certificates of benefit under a group insurance plan in effect for several years. These were insurance policies running from $500 to $1,000, depending on the length of service of the employe. W. R. B.

Providence, Rhode Island

OCTOBER 1, 1931.

Mike Kaplan Jewelry Company of Providence has been incorporated to conduct a jewelry business; authorized capital, stock, $3,000. Incorporators: **Herman J. Aisenberg, Arthur H. Feiner** and **Ira Marcus.**

James J. Nolan, Hazel H. Brown and **David Bromson,** of Providence, are incorporators of **White Stone Jewelry Corporation,** a jewelry business, with capital stock of 100 shares common, no par.

Albert J. Morris, 69 Whipple Avenue, Cranston, has filed a statement with the city clerk's office that he is sole owner of **Conduit Manufacturing Company,** 24 Conduit Street, Providence.

Federal Chain Company, Providence, has been incorporated to manufacture jewelry; authorized capital, $25,000; incorporators, **Adolph Jaeger, Hermine Jaeger, Russell L. Rooney** and **Emil Neiderberger.**

Pequot Metal Products Company, 226 Eddy Street, Providence, is owned and conducted by **Walter U. Fry.**

New England Foundrymen's Association was guest on Wednesday, August 12, of the **Providence Foundrymen's Association,** on the occasion of the annual outing of the latter organization, held at the Pomham Club, Riverside.

Frank H. Fairbrother, Sand Pond Road, Norwood, is owner of **Quaker Plating Company,** 109 Friendship Street, Providence.

Fred Mortensen, doing business under the firm style of the **Mueller Metal Company,** 65 Bassett Street, Providence, has filed a voluntary petition in bankruptcy in the United States District Court. He placed his liabilities at $3,827.62 and his assets at $2,314.08. W. H. M.

Middle Atlantic States

Central New York

OCTOBER 1, 1931.

Use of copper wire for electrical purposes in New York State will be stimulated if the campaign of education launched by the **New York State Association of Electrical Contractors and Dealers** takes the fancy of the public.

At a session of the association directors at Hotel Martin, Utica, N. Y., Sept. 10, **A. Lincoln Bush,** New York City, board chairman, asserted houses throughout the country are underwired.

"With the thousands upon thousands of electrical appliances sold in the past few years present wiring in homes is altogether inadequate," he asserted. "Much of the wiring is out-of-date. It cannot carry the present load safely. It is the object of this meeting to start an active campaign to make householders and structure owners realize it is time to re-wire. It will stimulate our business and will also help the unemployed."

A. D. Ross Fraser of the **General Cable Corporation,** Rome, N. Y., is taking an active part in the Utica Chapter of the National Association of Cost Accountants program for this season, aiding in laying out a series of programs and banquets to be held in Central New York cities.

Oneida Community, Ltd., denies that it is wrongfully using the name "Rogers" in the sale of silverware. In an answer filed this month to the suit filed by the **International Silver Company** in Federal Court in Utica, the Oneida Community charges the International Silver Company is not bringing its suit in good faith but it is bringing it "in spite and in disappointment" because it did not itself buy **William A. Rogers Ltd.,** of Canada. According to the Oneida Community brief, immediately after it purchased the Canadian company in 1929, the International started to wage propaganda against the Sherill company to injure it and if possible destroy the Rogers business of the company. The answer filed by the Oneida Community is signed by Louis Wayland Smith, vice-president. It asks dismissal of the International suit seeking to restrain the Community from using the name "Rogers."

In a counterclaim the Community asked the court to restrain the International from its alleged propaganda and interference with the Community business.

Employment in this area in the metal trades, according to industrial officials, is "nothing to brag about."

Reduction of $3,000,000 a year in operating and general expenses on the present rate of business has been made by **Remington-Rand** through reductions in salaries, wages, piece work rates, and general economies which went into effect Sept. 1, according to company officials. Loss for the quarter ending Sept. 30 will be the largest in the history of Remington-Rand, it was asserted in a statement given out by the company a few days ago. The concern, however, reports excellent reception of its new portable typewriter.

Reports that the **DuPont Company** will purchase the **Remington Arms** stock was the news of interest in the Mohawk Valley this month. An official of the DuPont company at Wilmington, Del., said his company would acquire a minority interest in a combination of firearms companies, provided the Remington Company succeeded in taking over the defunct **Winchester Repeating Arms Company.**

Robert Raymond Young, 19, a sophomore at Syracuse University, son of **F. W. Young,** vice-president of **Remington-Rand,** died in a Utica hospital this month. He was taken suddenly ill at an Adirondack resort, where it was found he had typhoid fever, and rushed to Utica. E. K. B.

Newark, New Jersey

OCTOBER 1, 1931.

Grigsby-Grunow Company, Chicago, has made application for a temporary injunction against the **Majestic Radio Tube Corporation,** of Harrison, N. J., charged with infringing on the Chicago company's trade-mark.

Sloan Valve Company, Chicago, has leased space on the tenth floor of the National Newark Building, to be used as a sales headquarters for New Jersey.

Standard Combustion Corporation, manufacturing oil burners at 215 Central Avenue, has been ordered by Vice-Chancellor Church to show cause why a receiver should not be appointed. Insolvency of the concern is charged.

United Lead Company contemplates building a factory at South Amboy, N. J., to cost $40,000.

Meat Edge Fiber Products Co. will erect a two-story brick and steel building, 50 by 150 feet, at Absecon, N. J., to cost $40,000.

Following Newark concerns have been incorporated: **Tele-Radio Corp.,** radio tubes, 2,500 shares no par. **Linam Company of America, Inc.,** chemicals, $300,000. **American Metal Spinning and Welding Company,** 10 shares no par.

C. A. L.

Trenton, New Jersey

OCTOBER 1, 1931.

Metal plants in Trenton report business conditions better than last month, and manufacturers feel very encouraged at this time. The **Jordan L. Mott Company** is now operating four and five days a week after experiencing a dull season. There has been little change at the **John A. Roebling Sons'**

Company, where employes quit work in the early afternoon. **Edgely Brass Company** reports business somewhat improved.

Dr. Edwin F. Northrup of Princeton and Trenton has been presented the Edward Acheson Medal for 1931 at a convention session of the Electro-Chemical Society, at Salt Lake City. Dr. Northrup spoke there on "What is Electricity?" Dr. Northrup is connected with the Ajax Electrothermic Corporation of Trenton. The honor came to him for outstanding work in the development of electric furnaces.

Franklin L. Meyer, long connected with the John A. Roebling's Sons Company, has resigned to devote his entire time to the Trenton School of Industrial Arts. In 1919 he has had charge of the advanced classes in electricity in the evening school, and will now conduct classes in this subject in the day technical course.

The **Roebling company** and the **Crescent Insulated Wire and Cable Company** were among the exhibitors at the recent Trenton fair.

Following concerns were incorporated at Trenton: **Service Chemical Corp.,** 6,000 share common, Paterson. **Universal Self-Lubricating Bearing Co.;** manufacture bushings; 200 shares common; New Brunswick. **Hydrox Chemical Co., Inc.,** $100,000, Camden. **Halstead-Haven, Inc.,** $25,000, chemicals, Montclair. C. A. L.

Middle Western States

Detroit, Michigan

October 1, 1931.

Nothing particularly encouraging can be said about industrial conditions in this area. That they are dull everyone admits. But they were expected, and therefore no one is particularly disappointed.

The coming four weeks, however, seem to have a more encouraging outlook. The motor car manufacturing concerns, it is understood, are planning to come into the fall market with new models much earlier this season than formerly. That, of course, means increased manufacturing activity, more buying of raw materials, and increased employment. But no one can forecast how far this will go, and much caution is manifested when it comes to commitments.

The nonferrous lines are much better situated than most other lines, and the outlook is much more promising. Manufacturing in general has been stagnant throughout the summer, and outside the automobile and nonferrous fields there is not much in sight in the way of encouragement.

The plating industry is doing very little. Many of the plants are practically idle, while others are only operating part time. But with the awakening demands from the automobile industry this probably will change for the better within the next few weeks.

Manufacturers of plumbing and steam fitting supplies are quiet, with little prospect of early improvement. Manufacturing jewelers are doing almost nothing.

Wolverine Smelting and Refining Co. was recently incorporated at Detroit, with capital of $30,000 and 100,000 shares of no par value.

Claude W. Cornelius, formerly associated with the **Wolverine Brass Works** at Grand Rapids, plans to establish a merchandising brokerage business in Grand Rapids and Atlanta, Ga., about January 1, it is announced.

Development of the commercial use of magnesium as a metal is reported to be a factor behind the recent accumulation of stock of the **Bohn Aluminum and Brass Corp.,** Detroit. It is stated that this corporation has been experimenting, along with the **Dow Chemical Company,** to discover additional uses for the commodity. It also is reported that the Bohn organization is perfecting a method of die casting which will make possible its more extensive use.

The annual shutdown of the **Chevrolet** foundry at Saginaw for inventory and equipment changes preparatory to production of new models, is announced for the near future. Various departments will close at intervals. The foundry will reopen about October 15, and probably resume operations with approximately the same working force as at present, slightly more than 3,000 men.

A plant expansion program to involve several hundred thousand dollars and eventually to cover an eleven-acre site, has been started by **Copeland Products, Inc.,** at Mt. Clemens, manufacturers of electric refrigerating units. The company, according to **Lloyd B. Pettys,** plant engineer, proposes the immediate construction of a $50,000 engineering building as the initial unit of the program. An increase in orders and shipments since the organization has been located in Mt. Clemens necessitated considerable crowding in the manufacturing plant, and forces the engineering and service departments to move.

Officials of the **W. B. Jarvis Co.,** manufacturers of automobile accessories, at Grand Rapids, reports operations on a 24-hour basis in several departments, and now is giving employment to 250 men.

Ford Motor Co., Dearborn, following three-weeks' curtailment in August, started to recall workers and it is reported that as many as 87,000 will be at their tasks again by October 1.

An extensive expansion program is reported in prospect at Midland, Mich., by the **Dow Chemical Company,** manufacturers of Dowmetal, magnesium alloys and other products. Dowmetal is one of the products of brine that is the principal source for the Dow products. It is considerably lighter than aluminum, and in experiments, the company asserts, has proven its value where lightness combined with exceptional strength is desired. Heretofore, its manufacture has been restricted by the lack of a suitable plant, but the proposed new building will provide facilities that the company expects will result in far greater production, with demand increased by a 40 per cent reduction in price. The present price of Dowmetal is from 30 to 50 cents a pound. F. J. H.

Wisconsin Notes

October 1, 1931.

An order for the dissolution of the **Wisconsin Art Bronze & Iron Co.,** Milwaukee, was entered Aug. 31 by Judge August E. Braun, in deciding a breach of contract suit brought against the company by the **General Bronze Corp.,** New York, which operates a subsidiary in Milwaukee. The court also granted a permanent injunction to the plaintiff New York company. An appeal to the Supreme Court is considered likely.

The Wisconsin Art Bronze Co. was organized in February. The firm was formed by **W. C. Schmeling, F. Van Kooy** and **Arthur R. Stark,** all former officers of the Wisconsin Ornamental Iron & Bronze Co., which was taken over by the General Bronze Co. in 1929.

These officers worked for a time for the General Bronze Co., and in January left its employ to form the Wisconsin Art Bronze & Iron Co. The New York firm immediately sought a restraining order and dissolution of the new company.

The terms of sale of the original Wisconsin Ornamental Iron to General Bronze provided that no officers of the original company should engage in a similar business in the Milwaukee territory for 15 years. The defendant company argued that the terms of the contract tended to restrain trade, induce monopoly, and therefore was against the public interest. But Judge Braun held that the terms of the sales contract must be considered liberal, as instruments of that kind go, and that many a more drastic and binding contract has been sustained by the courts.

Neenah Brass Works at Neenah has purchased the machinery and equipment of the **Johnson & Wells Machine Co.,** pioneer industrial enterprise in that city. Machinery and equipment of the machine company has been moved to the brass works. A. P. N.

Other Countries

Birmingham, England

SEPTEMBER 18, 1931.

The 24th annual autumn meeting of the Institute of Metals was held in Zurich from September 13 to 15, and was attended by over 200 members from 15 different countries. Apart from the ordinary business of the meeting there were works visits and social gatherings, and a series of short tours in Switzerland, visiting the Rigi, Lucerne, Interlaken, Thun and Chippies-Siders, at both of which latter places metal works were visited. Before returning home a party of members proceeded to Milan for the International Foundry Exhibition and Congress.

Industry generally in the Midlands continues to lag and, according to the latest returns for the week ended August 31 there were 267,464 wholly unemployed in the district, which represented an increase of 14,000 on the week.

An encouraging feature, however, is the rush to book space at the Birmingham Section of the British Industries Fair. In the same week the space booked amounted to over 10,000 square feet, with the result that 200,000 square feet in all is definitely booked, leaving unlet only about 40,000 square feet, of which a large amount is provisionally reserved. The General Manager of the Fair, in an interview, said, "While the majority of the bookings are by firms which have exhibited for many years, a notable feature is the return of exhibitors who have been missing recently."

N. C. Joseph, Ltd., Stratford-on-Avon and Birmingham, have just secured, in competition with European and American manufacturers, the largest order for aluminum hollow-ware that has ever been placed. They are to supply half a million pieces, principally saucepans, stewpans and kettles, for an overseas market, the articles to be shipped at the rate of 125,000 pieces a week. The firm has entered into another contract for the home trade for a quarter of a million aluminum saucepans, also for immediate delivery.

For some time there have been tests made on the River Severn at Worcester with motor boats which have been constructed of a special corrosion resisting aluminum alloy to which has been given the name Birmabright. Birmal Boats are made by a subsidiary company of the **Birmingham Aluminium Castings (1903), Ltd.** It is claimed they have greater strength and rigidity; that tropical deterioration is overcome; that they resist corrosion; that repairs are easily effected; that the teredo worm has been defeated; and that heavy depreciation has been eliminated. The idea has been evolved after years of research work and the company recently opened a yard at Southampton for the construction of boats in Birmabright. The success achieved in the construction of craft of under 30 ft. in length led the directors to seek to develop the idea, and they were successful in securing the order for a 55 ft. express cruiser, a boat which is now cruising in the Mediterranean. Practically the whole of the fittings throughout the boat are of special design and manufacture, while the plating and sections used in the framing structure of the hull were specially rolled and extruded for the purpose.—J. A. H.

Business Items — Verified

Aluminum Specialty Co., Manitowoc, Wis., has completed and equipped a new 3-story addition, 45 x 60 ft.

Stebbins Engineering & Manufacturing Co., Watertown, N. Y., have removed to new offices in that city, at 411 Trust Co. Building.

Wolverine Plating Co., 459 Brady Street, Detroit, Mich., is planning installation of equipment for still and mechanical barrel plating of cadmium. **John Tyler, Jr.**, is in charge.

American Manganese Bronze Co., Holmesburg, Pa., reports good business thus far in 1931, with plant working full time five days a week.

Smith Bros. Foundry, Ltd., Victoria, B. C., manufactures brass, aluminum and other nonferrous castings, and operates a machine shop, lacquering department, etc.

C. H. McAleer Manufacturing Co., Detroit, Mich., is considering plant expansion to cost over $50,000, including a new building addition to be started late in the fall. Company makes polishes and buffing compounds.

Kester Solder Company, makers of self-fluxing solder, announce the establishing and opening of a plant at Brantford, Canada, on September 15. The plant will be operated under the name of **Kester Solder Company of Canada, Limited.**

The DeVilbiss Company, Toledo, Ohio, has announced a reduction in prices of its entire line of NC ¼ HP electric motor driven portable spray painting outfits. Reductions range from 10 to 15 dollars per outfit.

Gucker Bros., Philadelphia, Pa., has purchased equipment of plant at 311 North 10th Street, for manufacture of switchboards, panel boards, junction boxes and kindred electrical apparatus. **Thomas Gucker, Jr.**, heads the firm.

Calorizing Company, Wilkinsburg, Pa., has adopted a group life insurance policy for protection of its 50 employees with policies ranging from $500 to $1,500, according to length of service, premiums for which company pays.

International-Stacey Corporation, Columbus, Ohio, announces that **B. T. Ehrnman,** who was formerly located in the Chicago office, has been transferred to St. Louis as Division Manager, with offices at Room 2192 Railway Exchange Building.

Hagerstown Bronze Aluminum Co., 710 Pennsylvania Avenue, Hagerstown, Md., has resumed operations after being shut down for four months. The company operates a foundry for brass, bronze, aluminum and gray iron, and does brazing. **C. R. Baumgardner** is president; **E. J. Kauffman,** secretary-treasurer.

Bound Brook Oil-less Bearing Co., Bound Brook, N. J., has formed a subsidiary, **Fischer Foundry Corp.,** which will operate the company's present nonferrous foundry. Officers of new company: **W. F. Jennings,** president; **L. A. J. Fischer,** vice-president, sales; **C. J. G. Fischer,** vice-president, production; **G. O. Smalley,** treasurer; **H. O. Johnson,** secretary; **Loren Wood,** counsel.

Review of the Wrought Metal Business

By J. J. WHITEHEAD

President of the Whitehead Metal Products Company of New York, Inc.

OCTOBER 1, 1931.

Progress during September was more satisfactory than during August. Perhaps one might say that September volume was as good as August, but as there were fewer business days it really showed some improvement. Considering the tremendous events which have taken place during the month, and looking at the situation in a broad way, it seems as if all bad news must be out. It probably is, but a little further cleaning up is necessary. The prices of commodities generally have remained fairly stable for about four months. To be sure, during that time copper has sagged off another cent, which is 10 to 15 per cent. It hardly seems likely that any further serious drops are to be looked for.

Shortages of fabricated goods exist all along the line, and the volume demand for such products is surely accumulating. This means that with any good news developing and resulting in a real buying wave, the price of commodities, and certainly the finished products, will respond. The response to such a buying movement will be a very rapid increase in prices. I believe that such a buying move is in the making for the near future, and that it will prove profitable to begin accumulating against requirements. A price increase will offset the carrying charges.

While there are ample stocks of copper in the form of ingots, wirebars, cakes, etc., nevertheless the stocks of fabricated products such as sheets, rods, wire, tube, etc., in the hands of manufacturers, jobbers and other sellers are at a minimum. It would almost seem as if a large part of the refined shapes should be in the form of the finished products at this time. If such were the case the stocks of refined shapes would not be so much above normal.

It is not possible to foretell prices, but certainly it would seem the part of wisdom to take advantage of the existing low levels for copper, tin, and other metals.

The demand for Monel and nickel continued in fair volume during the past month. Sales of Monel metal sinks are improving. The National Metal show held at Boston last month indicated that demand for stainless steel containing about 8 per cent nickel is going to be tremendous in the not far distant future.

The demand for aluminum in certain forms has eased up, but on the other hand the demand for rods has greatly improved. With the improvement in the general business situation the demand for aluminum as well as the other metals will also be on the upgrade.

In New England the shoe and woolen business is operating at capacity. The figures of the Bureau of Commerce show that New England is surely leaving the depression behind. Prices might slip a little more, but rather than trying to buy at the very bottom it might be well to take a minimum of risk and perhaps in little while accept a good profit. It looks if things might be or will get on the "up and up" track before very long.

Metal Market Review

By R. J. HOUSTON

D. Houston and Company, Metal Brokers, New York

COPPER

OCTOBER 1, 1931.

The market for copper was flattened to the lowest point in history by reason of the generally depressed condition in financial and industrial circles. With copper selling at 7 cents a pound it is certain all artificial factors have been eliminated from prices. Values have come down to the irreducible minimum, and a base has been reached from which recovery is liable to snap back quickly any day. A large potential demand awaits the return of average normal times.

There were two reductions in the export price during September. A quarter of a cent per pound was clipped off each time bringing the present quotation down to 7½ cents c. i. f. European ports. London copper declined £5 3s. 9d. in September for the spot position and £18 3s. 9d. since the beginning of the year. After the developments in recent months the time is at hand when the principal producers can and must join in a common policy to stop the demoralized conditions in the industry.

ZINC

Sales of zinc during September were on a restricted scale and prices eased off from 3.80 cents East St. Louis at the beginning of the month to 3.70 cents the present level. With so much unsettlement in all markets, consumers were conservative in placing orders. Consequently concessions were necessary to effect business, and even the shading of prices failed to stimulate a general buying movement. The latest monthly statistics showed a further decrease in stocks during August of 2,132 tons. There was a falling off in shipments, however, of 4,861 tons, and the surplus holdings on September 1 amounted to 129,701 tons.

TIN

Opening price of 26.75 cents for prompt Straits tin was the best of the month, but neither the activity at London nor the strong control of the situation by the International Tin Pool were able to prevent a gradual weakening of the market. By the middle of September the price sagged off to 25.40 cents, and in less than ten days there was a further decline to 23.00 cents for spot Straits tin.

Market conditions became highly irregular and unsettled on the announcement that Great Britain had abandoned the gold standard. This altered status in international finance had an immediate effect on prices and market losses of 1¼ cents per pound were recorded between September 18th and 21st. Speculative sentiment both in London and New York was nervous and apprehensive over the readjustment in values which naturally followed the decline in sterling exchange. It is interesting to note that every five point fluctuation in sterling makes a difference of nearly ¼ cent per lb. in the price of tin. The shift from the gold standard caused a sharp advance in the price of tin in London. The rise in quotations abroad, however, was largely due to the correction of the British pound sterling. The trend of the market became highly irregular and the prompt Straits tin price dropped to 22.87½ cents.

LEAD

There were some irregular developments injected into the lead situation lately due to offerings early in the month at 4.25 cents equal to New York delivery. The trading on this basis was in fairly large volume, although prices of prominent producers re-

mained unchanged at 4.40 cents for the New York position. The East St. Louis basis remained at 4.22½ cents until near the month end when concessions on western business began to appear, with fairly large sales at 4.10c and 4.15c East St. Louis. Total transactions for the month amounted to a large tonnage distributed amongst cable and battery manufacturers and other consumers. The latest statistics show a decrease in stocks of lead of 2,876 tons during August. Since June 1 there has been a total decrease in United States refined stocks of lead of 11,288 tons. The total carryover on September 1 amounted to 131,082 tons as against 72,832 tons a year ago. Present accumulations of surplus stocks are equal to between three and four months' requirements. For the last three months current consumption has been able to absorb production for that period plus a fair percentage of primary stocks.

ALUMINUM

While all other metals feel the strain and stress of recent international developments, aluminum is apparently impregnable as to market prices. These remain intact and stabilized amidst all the sensational changes that have taken place. Consuming demand is on a substantial scale and an increase in the rate of consumption is looked for in the near future. Imports of aluminum into this country in the first seven months of 1931 amounted to 10,658,059 pounds and compare with 17,457,863 pounds in the same period of 1930. United States exports of aluminum for the first seven months of this year totaled 3,869,910 pounds as against 14,741,868 pounds during the corresponding months of 1930.

SILVER

The silver question commands world-wide attention owing to the grave financial strain that exists in every country. The unprecedented decline of the white metal and its decreasing use for monetary purposes are engaging the careful thought and investigation of the keenest minds in the hope that some workable solution may be arrived at which will stabilize silver at its intrinsic worth. Its marketable value has been cut in half in less than three years, and this has greatly disorganized trade with the Far East and added to the prevailing economic depression. If the market value of silver remains at the present low level of around 28¾ cents an ounce, trade relations with China and India are bound to become more and more difficult. This seems to be a strategic time for the nations of the world to devise some form of international agreement for stabilizing silver at some fixed ratio to gold. Such an economic understanding would greatly help in leading the world out of the prevailing depression.

ANTIMONY

Consuming demand for antimony was quiet lately, and the easier tone of the market has not stimulated sales. The spot price for carload lots of Chinese regulus quotes 6.50c duty paid as against 6.60c a few weeks ago. Uncertainty over international exchange rates in the latter part of September made it difficult to establish a satisfactory trading basis. Sellers and buyers were both reticent to commit themselves in view of the erratic fluctuations in silver and exchange rates as they affected Chinese transactions. Business is confined to scattered lots and no sales worthy of special mention were reported. There were bids of a fraction below quoted prices for spot metal, but they failed to interest sellers pending more definite developments.

QUICKSILVER

Conditions in the quicksilver market were rather quiet and unsettled recently. Prices are irregular and more or less nominal at $76@$80 per flask, according to quantity. Stocks abroad are large and imports into this country show a sharp falling off during the current year. Production in the United States also has increased during the last four years, and this factor is obviously cutting down imports from Spain and Italy.

PLATINUM

Refined platinum quotes $37.50 to $40 per ounce. No special features are reported.

OLD METALS

A great deal of uncertainty prevails in the market for old metals. The unsettled state of the foreign exchange market has complicated matters considerably when export transactions are involved. Prices are already so low that holders hesitate to part with material at current minimum levels. Values are supposed to have some bottom and on present basis the risk lies with the seller rather than the buyer. Export outlet has been fair and somewhat better than domestic demand. Both buyers and sellers, however, are in a waiting attitude and hoping for some stimulating development that will stir the market to satisfactory activity.

Daily Metal Prices for the Month of September, 1931

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1	2	3	4	7*	8	9	10	11	14	15	16	17
Copper c/lb. Duty Free													
Lake (Del.)	7.875	7.875	7.875	7.875	.....	7.875	7.875	7.625	7.625	7.625	7.625	7.375	7.375
Electrolytic (f.a.s. N. Y.)	7.75	7.75	7.75	7.75	.....	7.75	7.75	7.50	7.50	7.50	7.50	7.25	7.25
Casting (f.o.b. ref.)	7.50	7.50	7.50	7.50	.....	7.375	7.25	7.25	7.25	7.25	7.00	7.00	7.00
Zinc (f.o.b. St. L.) c/lb. Duty 1¾c/lb.													
Prime Western	3.80	3.80	3.80	3.80	.....	3.80	3.80	3.80	3.80	3.80	3.775	3.75	3.75
Brass Special	3.90	3.90	3.90	3.90	.....	3.90	3.90	3.90	3.90	3.90	3.875	3.85	3.85
Tin (f.o.b. N. Y.) c/lb. Duty Free													
Straits	26.75	26.75	26.55	26.05	.....	25.70	25.70	25.875	25.70	25.50	25.40	25.10	25.05
Pig 99%	26.125	26.00	25.90	25.40	.....	25.05	25.10	25.25	25.075	24.90	24.80	24.50	24.45
Lead (f.o.b. St. L.) c/lb. Duty 2⅛c/lb.	4.225	4.225	4.225	4.225	.....	4.225	4.225	4.225	4.225	4.225	4.225	4.225	4.225
Aluminum c/lb. Duty 4c/lb.	23.30	23.30	23.30	23.30	.....	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30
Nickel c/lb. Duty 3c/lb.													
Ingot	35	35	35	35	.....	35	35	35	35	35	35	35	35
Shot	36	36	36	36	.....	36	36	36	36	36	36	36	36
Electrolytic	35	35	35	35	.....	35	35	35	35	35	35	35	35
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	6.60	6.60	6.60	6.60	.....	6.60	6.50	6.50	6.50	6.50	6.50	6.50	6.50
Silver c/oz. Troy Duty Free	27.625	27.50	27.625	27.625	.....	27.625	28.00	27.875	28.00	27.875	27.75	27.875	27.625
Platinum $/oz. Troy Duty Free	37.50	37.50	37.50	37.50	.....	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50

	18	21	22	23	24	25	28	29	30	High	Low	Aver.
Copper c/lb. Duty Free												
Lake (Del.)	7.375	7.375	7.375	7.375	7.375	7.375	7.375	7.375	7.375	7.875	7.375	7.565
Electrolytic (f.a.s. N. Y.)	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.75	7.25	7.440
Casting (f.o.b. ref.)	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.50	7.00	7.161
Zinc (f.o.b. St. L.) c/lb. Duty 1¾c/lb.												
Prime Western	3.725	3.70	3.70	3.70	3.70	3.70	3.70	3.65	3.65	3.80	3.65	3.748
Brass Special	3.825	3.80	3.80	3.80	3.80	3.80	3.80	3.75	3.75	3.90	3.75	3.848
Tin (f.o.b. N. Y.) c/lb. Duty Free												
Straits	24.75	23.50	23.50	23.25	23.00	22.875	22.375	22.25	22.60	26.75	22.25	24.677
Pig 99%	24.20	23.00	22.875	22.625	22.50	22.25	21.75	21.625	22.00	26.125	21.625	24.065
Lead (f.o.b. St. L.) c/lb. Duty 2⅛c/lb.	4.225	4.225	4.225	4.225	4.225	4.225	4.225	4.225	4.225	4.225	4.225	4.225
Aluminum c/lb. Duty 4c/lb.	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30
Nickel c/lb. Duty 3c/lb.												
Ingot	35	35	35	35	35	35	35	35	35	35	35	35
Shot	36	36	36	36	36	36	36	36	36	36	36	36
Electrolytic	35	35	35	35	35	35	35	35	35	35	35	35
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.60	6.60	6.60	6.50	6.533
Silver c/oz. Troy Duty Free	27.50	29.25	28.625	29.50	29.125	31.00	28.625	28.125	27.50	31.00	27.50	28.202
Platinum $/oz. Troy Duty Free	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50

*Holiday.

Metal Prices, October 5, 1931

(Duties mentioned refer to U. S. tariffs on imports, as given in the Tariff Act of 1930.)

NEW METALS

Copper: Lake, 7.375. Electrolytic, 7.00. Casting, 7.00.
Zinc: Prime Western, 3.60. Brass Special, 3.70.
Tin: Straits, 22.50. Pig, 99%, 21.875.
Lead: 3.825. **Aluminum,** 23.30. **Antimony,** 6.55.
Nickel: Ingot, 35. Shot, 36. Elec. 35. Pellets, 40.
Quicksilver: flask, 75 lbs., $80. **Bismuth,** $1.50.
Cadmium, 55. **Cobalt,** 97%, $2.50. **Silver,** oz., Troy (N. Y. official price October 6), 28.75.
Gold: oz., Troy, $20.67. **Platinum,** oz., Troy, $37.50 to $40.00.

Duties: Copper, free; zinc, 1¾c. lb.; tin, free; lead, 2⅛c. lb.; nickel, 3c. lb.; quicksilver, 25c. lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

INGOT METALS AND ALLOYS

		Duty
Brass Ingots, Yellow	6¼ to 7½	45%
Brass Ingots, Red	7⅜ to 8¼	45%
Bronze Ingots	9 to 11	45%
Casting Aluminum Alloys	19 to 22	4c. lb.
Manganese Bronze Castings	18 to 35	45%
Manganese Bronze Ingots	7½ to 11	45%
Manganese Bronze Forgings	26 to 35	45%
Manganese Copper, 30%	17 to 30	25%
Monel Metal Shot or Blocks	28	25%
Phosphor Bronze Ingots	9 to 12	45%
Phosphor Copper, guaranteed 15%	11 to 15	3c. lb.
Phosphor Copper, guaranteed 10%	10¼ to 14	3c. lb.
Phosphor Tin, no guarantee	30 to 40	Free
Silicon Copper, 10%	17 to 35	45%
Iridium Platinum, 5%	$43.00	Free
Iridium Platinum, 10%	46.00	Free

OLD METALS

Dealers' buying prices, wholesale quantities	Cents lb.	Duty
Heavy copper and wire, mixed	4¾ to 5	Free
New copper clippings	4¾ to 5	Free
Light copper	4¼ to 4½	Free
Heavy yellow brass	2⅝ to 2⅞	Free
Light brass	2⅛ to 2⅜	Free
No. 1 composition	4 to 4¼	Free
Composition turnings	3½ to 4	Free
Heavy soft lead	3⅛ to 3⅜	2⅛c. lb.
Old zinc	1¼ to 1½	1½c. lb.
New zinc clips	2 to 2¼	1½c. lb.
Aluminum clips (new, soft)	13 to 14	4c. lb.
Scrap aluminum, cast, mixed	3½ to 3¾	4c. lb.
Scrap aluminum sheet (old)	9½ to 10	4c. lb.
No. 1 pewter	12 to 13	Free
Nickel anodes	21½ to 23½	10%
Nickel sheet clips; rod ends (new)	7½ to 8	10%
Monel scrap	6 to 7	3c. lb.

Wrought Metals and Alloys

Base Mill Shipment Prices, 1,000 lbs. or more. Effective October 1, 1931

COPPER MATERIAL

	Net base per lb.	Duty
Sheet, hot rolled		2½c. lb.
Mill shipment	16⅛c.	
Bare wire	9 c.	25%
Seamless tubing	15⅝c.	7c. lb.
Soldering coppers	15⅝c.	45%

NICKEL SILVER (NICKELENE)

Net base prices per lb. (Duty 30% ad valorem.)

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	20¼c.	10% Quality	23⅜c.
15% Quality	22½c.	15% Quality	27⅜c.
18% Quality	23¾c.	18% Quality	30⅞c.

ALUMINUM SHEET AND COIL

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, ton lots, per lb.	32.30
Aluminum coils, 24 ga., base price	30.00

ROLLED NICKEL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Net Base Prices

Cold Drawn Rods	50c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	45c.	Full Finished Sheet	52c.

MONEL METAL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Hot Rolled Rods (base)	35	Full Finished Sheets (base)	42
Cold Drawn Rods (base)	40	Cold Rolled Sheets (base)	50

SILVER SHEET

Rolled sterling silver (October 6) 32.00, Troy oz. upward, according to quantity. (Duty free.)

BRASS MATERIAL—MILL SHIPMENTS

Net base prices per pound

	High Brass	Low Brass	Bronze	Duty
Sheet	13 c.	14¼c.	14⅝c.	4c. lb.
Wire	13½c.	14¾c.	15⅛c.	25%
Rod	11¼c.	14¾c.	15⅛c.	4c. lb.
Brazed tubing	22½c.		26 c.	12c. lb.
Open seam tubing	20¾c.		22⅜c.	25%
Angles, channels	20¾c.		22⅜c.	12c. lb.
Seamless tubing	16¼c.		17¾c.	8c. lb.

TOBIN BRONZE AND MUNTZ METAL

(Duty 4c. lb.) Net base prices per pound.

Tobin Bronze Rod	15 c.
Muntz or Yellow Metal Sheathing (14"x48")	15⅛c.
Muntz or Yellow Rectangular sheet other sheathing	15⅛c.
Muntz or Yellow Metal Rod	12¼c.

ZINC AND LEAD SHEET

	Cents per lb. Net Base	Duty
Zinc sheet, carload lots, standard sizes and gauges, at mill, less 7 per cent discount	9.00	2c. lb.
Zinc sheet, open casks (jobbers' price)	9.25	2c. lb.
Zinc sheet, open casks (jobbers' price)	10.00 to 10.25	2c. lb.
Full Lead Sheet (base price)	7.25	2⅛c. lb.
Cut Lead Sheet (base price)	7.50	2⅛c. lb.

BLOCK TIN SHEET

(Duty free.)

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 12c. over N. Y. Pig Tin; 50 to 100 lbs., 18c. over; 25 to 50 lbs., 20c. over; less than 25 lbs., 25c. over.

BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 10c. over N. Y. tin price; 100 lbs. to 500 lbs., 12c. over; 50 to 100 lbs., 18c. over; 25 to 50 lbs., 20c. over; less than 25 lbs., 25c. over. Prices F. O. B. mill (Duty free.)

Supply Prices, October 5, 1931

ANODES

Copper:	Cast	18⅝c. per lb.
	Rolled, sheets, trimmed	17½c. per lb.
	Rolled, oval	15⅜c. per lb.
Brass:	Cast	18⅜c. per lb.
Zinc:	Cast	10½c. per lb.

Nickel:	90-92%	44c.	to 45c. per lb.
	95-97%	44c	to 47c. per lb.
	99%	46½c.	to 49c. per lb.

Silver: Rolled silver anodes .999 fine were quoted October 6 from 32.00c. per Troy ounce upward, depending upon quantity.

FELT POLISHING WHEELS WHITE SPANISH

Diameter	Thickness	Under 50 lbs.	50 to 100 lbs.	Over 100 lbs.
10-12-14 & 16	1" to 2"	$3.00/lb.	$2.75/lb.	$2.65/lb.
10-12-14 & 16	2 to 3½	3.00	2.70	2.50
6-8 & over 16	1 to 3½	3.10	2.85	2.70-2.75
6 to 24	Under ½	4.25	4.00	3.90
6 to 24	½ to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 to 6	¼ to 3	4.85	4.85	4.85
4 to 6	Over 3	5.25	5.25	5.25
Under 4	¼ to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

On grey Mexican wheels deduct 10c. per lb. from White Spanish.

COTTON BUFFS

Full disc open buffs, per 100 sections, when purchased in lots of 100 or less:

11" 20 ply 64/68 Unbleached	$17.10	to 18.25
14" 20 ply 64/68 Unbleached	26.03	to 27.50
11" 20 ply 80/92 Unbleached	20.90	to 21.92
14" 20 ply 80/92 Unbleached	32.30	to 34.00
11" 20 ply 84/92 Unbleached	25.70	to 32.04
14" 20 ply 84/92 Unbleached	42.00	to 47.52
11" 20 ply 80/84 Unbleached	24.60	to 29.37
14" 20 ply 80/84 Unbleached	40.10	to 43.55

Sewed Pieced Buffs, per lb., bleached 45c. to 71c.

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.09¾-.14
Acid—Boric (Boracic) Powdered	lb.	.08⅛-.09½
Chromic, 75 to 400 lb. drums	lb.	.14¼-.17½
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb.	.06
Hydrofluoric, 30%, bbls.	lb.	.08
Nitric, 36 deg., carboys	lb.	.06
Nitric, 42 deg., carboys	lb.	.07
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl	lb.	.15¾-.21¼
Denatured drums	gal.	.27-.33
Alum—Lump, barrels	lb.	.03¼-.04
Powdered, barrels	lb.	.03½-.04
Ammonium sulphate, tech., bbls.	lb.	.03½
Sulphocyanide	lb.	.36
Arsenic, white, kegs	lb.	.04½-.05
Asphaltum	lb.	.35
Benzol, pure	gal.	.58
Borax Crystals (Sodium Biborate), bbls.	lb.	.04½
Cadmium oxide, 50 to 1,000 lbs.	lb.	.65
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.06
Chrome Green, bbls.	lb.	.24
Chromic Sulphate	lb.	.30-.40
Copper—Acetate (Verdigris)	lb.	.23
Carbonate, bbls.	lb.	.15-.16
Cyanide (100 lb. kgs.)	lb.	.41
Sulphate, bbls.	lb.	.043-.0475
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar, bags	ton	.04½
Gold Chloride	oz.	$12.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.59-.61
Iron Sulphate (Copperas), bbl.	lb.	.01½
Lacquer Solvents	gal.	.85
Lead Acetate (Sugar of Lead)	lb.	.13¼
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Nickel—Carbonate, dry bbls.	lb.	.32
Chloride, bbls.	lb.	.18-.19½
Salts, single, 300 lb. bbls.	lb.	.10½-.13
Salts, double, 425 lb. bbls.	lb.	.10½-.13
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash Caustic Electrolytic 88-92% broken, drums	lb.	.06¾-.08½
Potassium Bichromate, casks (crystals)	lb.	.09¼
Carbonate, 96-98%	lb.	.06¾
Cyanide, 165 lbs. cases, 94-96%	lb.	.50-.60
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in bbls.	lb.	.04½-.05¾
Silver Chloride, dry, 100 oz. lots	oz.	.25¾
Cyanide (fluctuating)	oz.	.33¼
Nitrate, 100 ounce lots	oz.	.22¼
Soda Ash, 58%, bbls.	lb.	.023
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.16½-.17
Hyposulphite, kegs	lb.	.03½-.04
Nitrate, tech., bbls.	lb.	.03¾
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass), bbls.	lb.	.02
Stannate	lb.	.24
Sulphocyanide	lb.	.32½-.45
Sulphur (Brimstone), bbls.	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.25½-.27
Tripoli, Powdered	lb.	.03
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc, Carbonate, bbls.	lb.	.11
Chloride, casks	lb.	.06¾
Cyanide (100 lb. kegs)	lb.	.38
Sulphate, bbls.	lb.	.03½